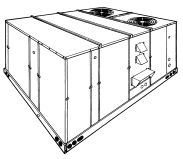
INSTALLATION MANUAL

R-410A
ZF SERIES

15 - 25 Ton

60 Hertz



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General

YORK® Model ZF units are either single package air conditions equipped with optional factory installed electric heaters, or single package gas-fired central heating furnaces with cooling unit. Both are designed for outdoor installation on a rooftop or slab.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, gas connection, duct connections, installation of combustion air inlet hood, flue gas outlet hoods and fixed outdoor air intake damper (units without economizer or motorized damper option only) at the point of installation.

The supplemental electric heaters have nickel-chrome elements and utilize single point power connection.

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot. All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./Propane with Kit Model # 1NP0418. See Gas Heat Application Data Table.

Safety Considerations

This is a safety alert symbol. When you see this symbol on labels or in manuals, be alert to the potential for personal injury.

Understand and pay particular attention the signal words **DANGER**, **WARNING** or **CAUTION**.

DANGER indicates an **imminently** hazardous situation, which, if not avoided, **will result in death or serious injury.**

WARNING indicates a **potentially** hazardous situation, which, if not avoided, **could result in death or serious injury.**

CAUTION indicates a potentially hazardous situation, which, if not avoided **may result in minor or moderate injury.** It is also used to alert against unsafe practices and hazards involving only property damage.

⚠WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual for assistance or for additional information, consult a qualified contractor, installer or service agency.

⚠ CAUTION

This product must be installed in strict compliance with the installation instructions and any applicable local, state and national codes including, but not limited to building, electrical, and mechanical codes.

⚠WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury. Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system. Gage sets, hoses, refrigerant containers and recovery systems must be designed to handle R-410A. If you are unsure, consult the equipment manufacturer. Failure to use R-410A compatible servicing equipment may result in property damage or injury.

⚠WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

a. Do not try to light any appliance.

b. Do not touch any electrical switch; do not use any phone in your building.

c. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

d. If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Due to system pressure, moving parts, and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained service personnel should install, repair, or service this equipment. Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters.

Observe all precautions in the literature, labels, and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other applicable safety precautions and codes including ANSI Z223.1 or CSA-B149.1- latest edition.

Wear safety glasses and work gloves. Use quenching cloth and have a fire extinguisher available during brazing operations.

Inspection

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state and national codes including, but not limited to, building, electrical, and mechanical codes.

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG.

Reference

Additional information is available in the following reference forms:

- Technical Guide - ZF180-300, 251934
- General Installation - ZF180-300, 853632

Renewal Parts

Contact your local York® parts distribution center for authorized replacement parts.

Approvals

Design certified by CSA as follows:

1. For use as a cooling only unit, cooling unit with supplemental electric heat or a forced air furnace.
2. For outdoor installation only.
3. For installation on combustible material.
4. For use with natural gas (convertible to LP with kit).

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to, building, electrical, and mechanical codes.

⚠ WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

Nomenclature

15-25 Ton Sunline™ Model Number Nomenclature

Z	F	180	N24	A	2	A	AA	2	0	1	2	4	A

Product Category
Z = A/C, Single Pkg., R-410A

Product Identifier
F = 10 thru 11 EER A/C

Nominal Cooling Capacity
180 = 15 Ton
210 = 17.5 Ton
240 = 20 Ton
300 = 25 Ton

Heat Type and Nominal Heat Capacity
C00 = Cooling Only. No field installed electric heat

Gas Heat Options
N24 = 240 MBH Output Aluminized Steel
N32 = 320 MBH Output Aluminized Steel
S24 = 240 MBH Output Stainless Steel
S32 = 320 MBH Output Stainless Steel

Electric Heat Options
E18 = 18 KW
E36 = 36 KW
E54 = 54 KW
E72 = 72 KW

Airflow
A = Std. Motor
B = Std. Motor/Economizer
C = Std. Motor/Economizer/Power Exhaust (Downflow Only)
D = Std. Motor/Motorized Damper
E = Std. Motor/Motorized Damper/Barometric Relief
J = Std. Motor/Economizer/Barometric Relief
N = Hi Static
P = Hi Static/Economizer
Q = Hi Static/Economizer/Power Exhaust (Downflow Only)
R = Hi Static/Motorized Damper
K = Hi Static/Motorized Damper/Barometric Relief
S = Hi Static/Economizer/Barometric Relief
2 = Low Static
3 = Low Static/Economizer
4 = Low Static/Economizer/Power Exhaust (Downflow Only)
5 = Low Static/Motorized Damper
6 = Low Static/Motorized Damper/Barometric Relief
7 = Low Static/Economizer/Barometric Relief

Voltage
2 = 208/230-3-60
4 = 460-3-60
5 = 575-3-60

Product Style
A = Style A

Configuration Options (not required for all units)
These four digits will not be assigned until a quote is requested, or an order placed.

- SS Drain Pan
- CPC Controller, DFS, APS
- Johnson Controller UNT 1126 (N2 protocol), DFS, APS
- Honeywell Controller, DFS, APS
- Novar Controller, DFS, APS
- Simplicity IntelliComfort II Controller
- Simplicity IntelliComfort II Controller Simplicity™LINC
- York Commercial Comfort System (YCCS) Rtu Controller
- Hot Gas Bypass (Standard on VAV, Optional on CV)
- IntelliSpeed with VFD
- IntelliSpeed, VFD and Manual Bypass
- IntelliSpeed, VFD Ready (for customer-provided, field-installed drive)
- Variable Air Volume, VFD (not available with factory installed BAS options)
- Variable Air Volume, VFD with Simplicity™LINC (not available with factory installed BAS options)
- Variable Air Volume, VFD and Manual Bypass (not available with factory installed BAS options)
- Variable Air Volume, VFD and Manual Bypass with Simplicity™LINC (not available with factory installed BAS options)
- Variable Air Volume, VFD (BAS ready)
- Variable Air Volume, VFD and Manual Bypass (BAS ready)
- Variable Air Volume, VFD Ready (for customer provided, field installed drive)
- Variable Air Volume, VFD Ready with Simplicity™LINC (for customer-provided, field-installed drive)
- 2" Pleated Filters, MERV 7
- 4" Pleated Filters, MERV 13
- BAS Ready Economizer (2-10 V.D.C. Actuator without a controller)
- Double Wall Construction
- Any Combination of Additional Options that Don't Have an Option Code Pre-assigned

Product Generation
2 = Second Generation

Additional Options

Standard Cabinet	Hinged Filter Door & Tool Free Access Cabinet
AA = None AB = Phase Monitor AC = Coil Guard AD = Dirty Filter Switch AE = Phase Monitor & Coil Guard AF = Phase Monitor & Dirty Filter Switch AG = Coil Guard & Dirty Filter Switch AH = Phase Monitor, Coil Guard & Dirty Filter Switch RC = Coil Guard & American Flag TA = Technicoat Condenser Coil TJ = Technicoat Evaporator Coil TS = Technicoat Evaporator & Condenser Coils EA = ElectroFin Condenser Coil EJ = ElectroFin Evaporator Coil ES = ElectroFin Cond & Evap Coils	BA = Hinged Filter Door & Tool Free Access Panels BB = Phase Monitor, Hinged Filter Door & Tool Free Access Panels BC = Coil Guard, Hinged Filter Door & Tool Free Access Panels BD = Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels BE = Phase Monitor & Coil Guard, Hinged Filter Door & Tool Free Access Panels BF = Phase Monitor & Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels BG = Coil Guard & Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels BH = Phase Monitor, Coil Guard & Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels

ZZ = If desired option combination is not listed above, ZZ will be assigned and configuration options will be located in digits 15-18.

Installation Options

A = No Options Installed B = Option 1 C = Option 2 D = Options 1 & 2 E = Option 3 F = Option 4 G = Options 1 & 3 H = Options 1 & 4 J = Options 1, 2 & 3 K = Options 1, 2, & 4 L = Options 1,3 & 4 M = Options 1, 2, 3, & 4	N = Options 2 & 3 P = Options 2 & 4 Q = Options 2, 3, & 4 R = Options 3 & 4 S = Option 5 T = Options 1 & 5 U = Options 1, 3, & 5 V = Options 1, 4, & 5 W = Options 1, 3, 4, & 5 X = Options 3 & 5 Y = Options 4 & 5 Z = Options 3, 4 & 5

Options

1 = Disconnect 2 = Non-Pwr'd Conv. Outlet 3 = Smoke Detector S.A.	4 = Smoke Detector R.A. 5 = Pwr'd Conv. Outlet

Installation

Installation Safety Information

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. Refer to the unit rating plate for the approved type of gas for this product.
2. Install this unit only in a location and position as specified on Page 7 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 5, 29 and 53 of these instructions.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 28 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

6. If a factory option convenience outlet is installed, the weatherproof outlet cover must be field installed. The cover shall be located in the unit control box. To install the cover, remove the shipping label covering the convenience outlet, follow the instructions on the back of the weatherproof cover box, and attach the cover to the unit using the (4) screws provided.

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units with factory installed Powered Convenience Outlet Option are wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

Limitations

These units must be installed in accordance with the following:

In U.S.A.:

1. National Electrical Code, ANSI/NFPA No. 70 - Latest Edition
2. National Fuel Gas Code, ANSI Z223.1 - Latest Edition
3. Gas-Fired Central Furnace Standard, ANSI Z21.47a. - Latest Edition
4. Local building codes, and
5. Local gas utility requirements

In Canada:

1. Canadian Electrical Code, CSA C22.1
2. Installation Codes, CSA - B149.1.
3. Local plumbing and waste water codes, and
4. Other applicable local codes.

Refer to unit application data found in this document.

After installation, gas fired units must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or customer's expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of Air Conditioning Contractors of America (ACCA).

This furnace is not to be used for temporary heating of buildings or structures under construction.

⚠ CAUTION

The Simplicity® control board used in this product will effectively operate the cooling system down to 0°F when this product is applied in a comfort cooling application for people. An economizer is typically included in this type of application. When applying this product for process cooling applications (computer rooms, switchgear, etc.), please reference applications bulletin AE-011-07 or call the applications department for Unitary Products @ 1-877-UPG-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30°F.

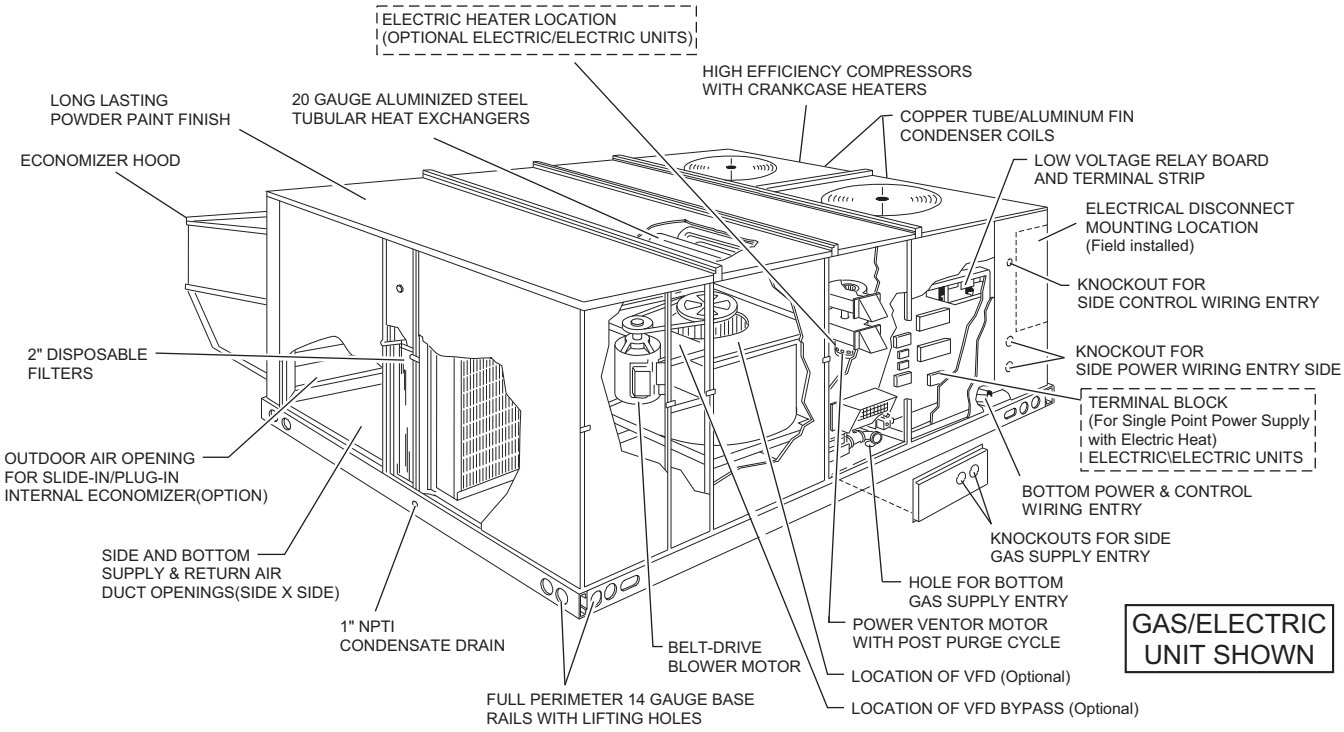


Figure 1: ZF180-300 Component Location

Table 1: ZF180-300 Unit Limitations

Size (Tons)	Unit Voltage	Unit Limitations		
		Applied Voltage		Outdoor DB Temp
		Min	Max	Max (°F)
180 (15)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125
210 (17.5)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125
240 (20)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125
300 (25)	208/230-3-60	187	252	125
	460-3-60	432	504	125
	575-3-60	540	630	125

Location

Use the following guidelines to select a suitable location for these units:

1. Unit is designed for *outdoor installation only*.
2. Condenser coils must have an unlimited supply of air. Where a choice of location is possible, position the unit on either north or east side of building.
3. Suitable for mounting on roof curb.
4. For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.
5. Roof structures must be able to support the weight of the unit and its options/accessories. Unit must be installed on a solid, level roof curb or appropriate angle iron frame.
6. Maintain level tolerance to 1/2” across the entire width and length of unit.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solution, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

Clearances

All units require particular clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with section 5.3 of Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 – Latest Edition (in U.S.A.), or Sections 7.2, 7.3, or 7.4 of Gas Installation Codes, CSA-B149.1 (in Canada) - Latest Edition, and/or applicable provisions of the local building codes. Refer to Table 6 for clearances required for combustible construction, servicing, and proper unit operation.

⚠WARNING

Do not permit overhanging structures or shrubs to obstruct condenser air discharge outlet, combustion air inlet or vent outlets.

Rigging And Handling

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars, whose length exceeds the largest dimension across the unit, **MUST** be used across the top of the unit.

⚠ CAUTION

If a unit is to be installed on a roof curb other than a York® roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

⚠ CAUTION

Before lifting, make sure the unit weight is distributed equally on the rigging cables so it will lift evenly.

Units may be moved or lifted with a forklift, from the side only, providing an accessory skid is used.

LENGTH OF FORKS MUST BE A MINIMUM OF 90 INCHES.

⚠ CAUTION

All panels must be secured in place when the unit is lifted.

The condenser coils should be protected from rigging cable damage with plywood or other suitable material.

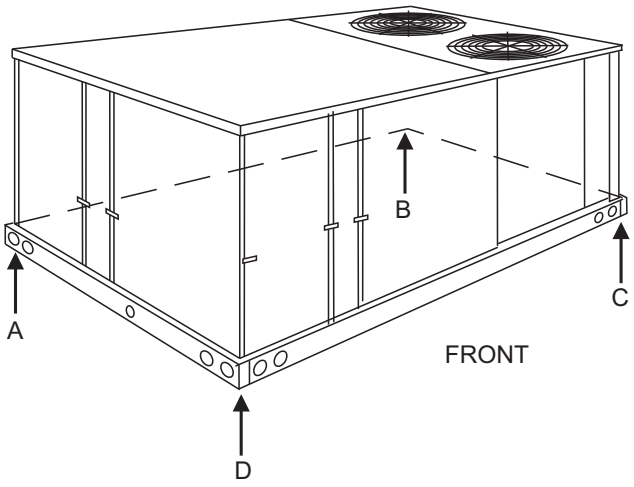


Figure 2: Unit 4 Point Load Weight

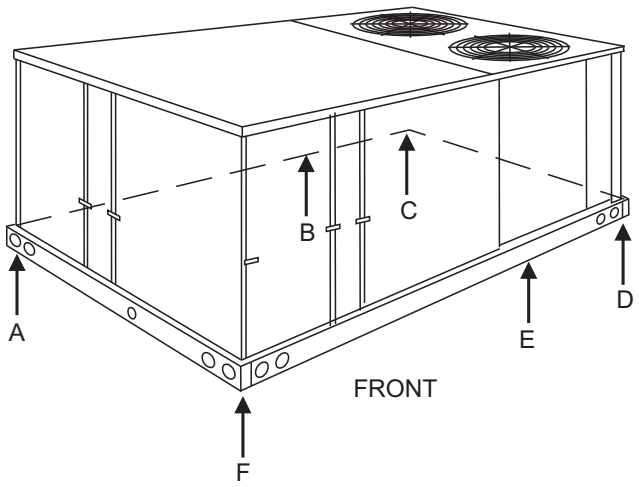


Figure 3: Unit 6 Point Load Weight

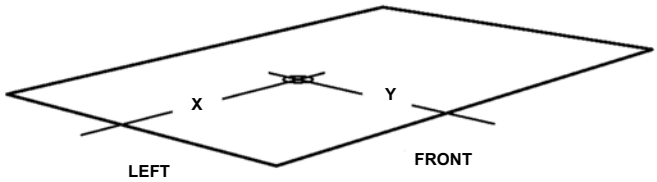


Figure 4: Center of Gravity

Table 2: Weights and Dimensions

Size (Tons)	Model	Weight (lbs.)	Center of Gravity		4 Point Load Location (lbs.)				6 Point Load Location (lbs.)					
		Shipping	X	Y	A	B	C	D	A	B	C	D	E	F
180 (15)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
210 (17.5)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
240 (20)	ZF	2538	70	44	589	622	679	643	389	404	419	457	440	425
300 (25)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 3: ZF180-300 Unit Accessory Weights

Unit Accessory	Weight (lbs.)	
	Shipping	Operating
Economizer	165	160
Power Exhaust	90	85
Electric Heat[1]	40	40
Gas Heat[2]	240	240
Double Wall	260	260
Motorized Damper	150	150
Barometric Damper	50	45
Econ./Motorized Damper Rain Hood	60	55
Econ./Power Exhaust Rain Hood	95	90
Wood Skid	220	220
Roof Curb	190	185
Hot Gas Bypass	10	10
Supply Fan VFD	See Table 5	

1. Weight given is for the maximum heater size available (54KW).
2. Weight given is for the maximum number of tube heat exchangers available (8 tube).

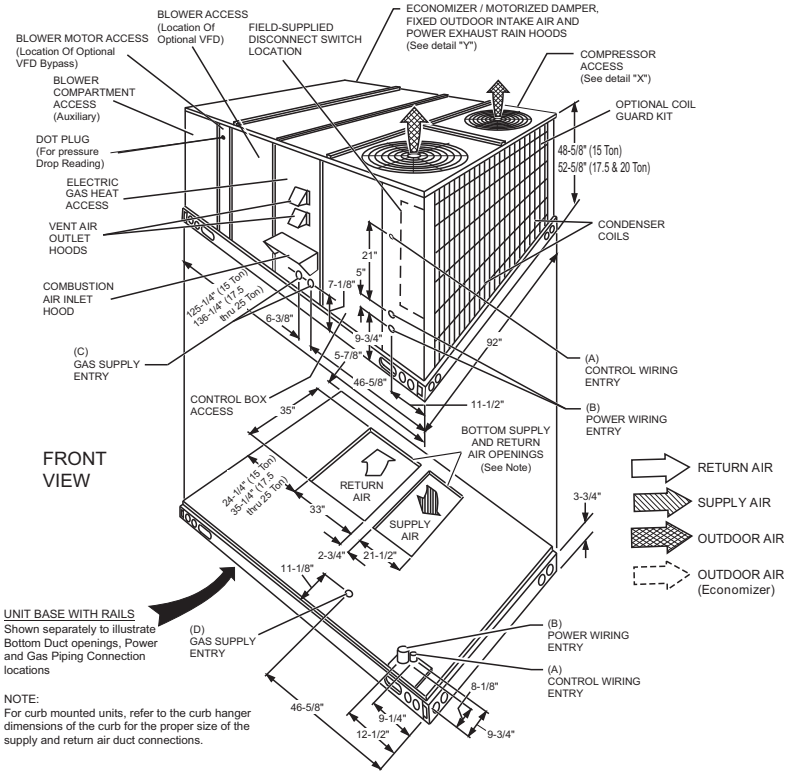


Figure 5: ZF180-300 Unit Dimensions Front View

Table 4: Utilities Entry

Hole	Opening Size Diameter	Used For	
A	1-1/8" KO	Control Wiring	Front
	3/4" NPS (Fem.)		Bottom
B	3-5/8" KO	Power Wiring	Front
	3" NPS (Fem.)		Bottom
C	2-3/8" KO	Gas Piping (Front)[1]	
D	1-11/16" Hole	Gas Piping (Bottom)[1,2]	

1. One-inch Gas Piping NPT Required.
2. Opening in the bottom to the unit can be located by the slice in the insulation.

Note: All entry holes should be sealed to prevent rain water entry into building.

Table 5: Supply Fan VFD Weights, In Lbs.

Supply Fan Motor	230V	460V	575V
W/O Manual Bypass			
5.0 hp	25	25	30
7.5 hp	30	30	30
10.0 hp	30	30	35
15.0 hp	30	30	40
W/Manual Bypass			
5.0 hp	30	30	35
7.5 hp	35	35	35
10.0 hp	35	35	40
15.0 hp	40	35	45

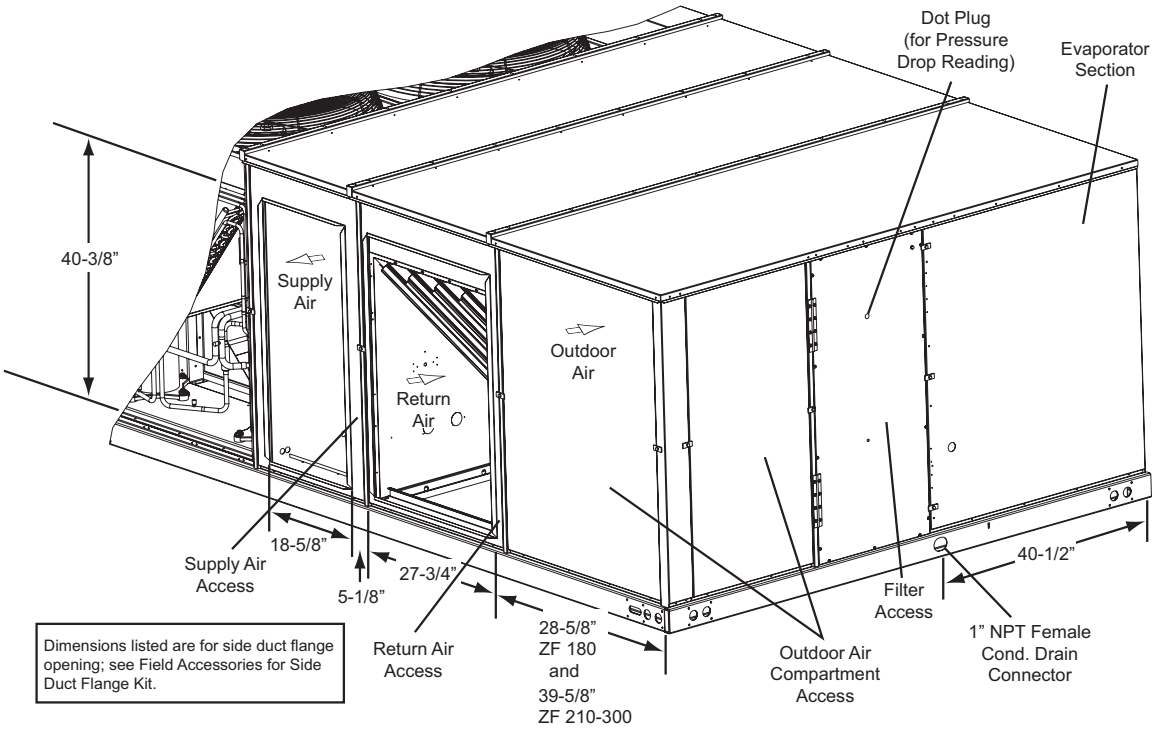


Figure 6: ZF180-300 Unit Dimensions Rear View

NOTE: Units are shipped with the bottom duct openings covered. An accessory flange kit is available for connecting side ducts.

For <u>bottom</u> duct applications:

1. Remove the side panels from the supply and return air compartments to gain access to the bottom supply and return air duct covers.
2. Remove and discard the bottom duct covers. Duct openings are closed with sheet metal covers except when the unit includes a power exhaust option. The covering consists of a heavy black paper composition.
3. Replace the side supply and return air compartment panels.

For <u>side</u> duct applications:

1. Replace the side panels on the supply and return air compartments with the accessory flange kit panels.
2. Connect ductwork to the flanges on those panels.

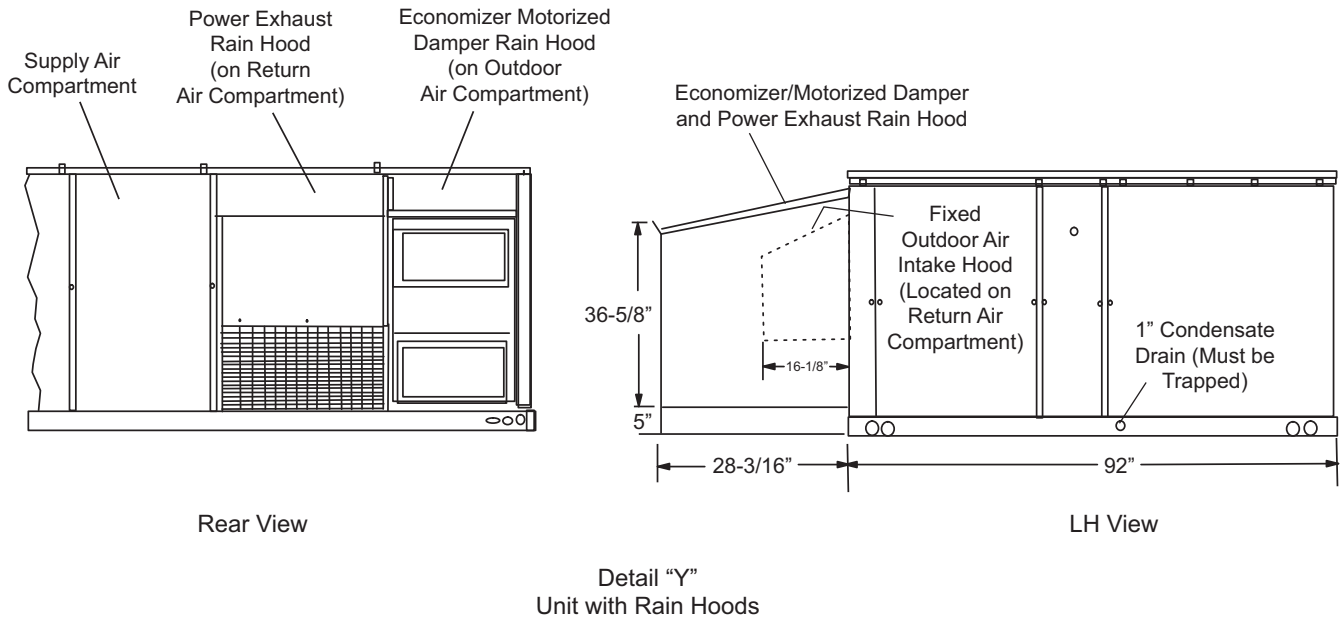


Figure 7: ZF180-300 Unit Dimensions Rain Hood

Table 6: ZF180-300 Unit Clearances

Direction	Distance (in.)	Direction	Distance (in.)
Top[1]	72 With 36 Maximum Horizontal Overhang (For Condenser Air Discharge)	Right	36
Front	36	Bottom[2]	0
Rear	24 (W/O Economizer)	Left	24 (W/O Economizer)
	49 (W/Economizer)		36 (W/Economizer)[3]

1. Units must be installed outdoors. Over hanging structure or shrubs should not obscure condenser air discharge outlet.
2. Units may be installed on combustable floors made from wood or class A, B or C roof covering materials.
3. If economizer is factory installed, the unassembled rain hood must be removed from its ride along position in front of the evaporator coil, or in the outdoor air compartment, prior to final installation.

Note: ELEC/ELEC Models: Units and ductwork are approved for zero clearance to combustible material when equipped with electric heaters.
GAS/ELEC Models: A 1" clearance must be provided between any combustible material and the supply air ductwork for a distance of 3 feet from the unit.
The products of combustion must not be allowed to accumulate within a confined space and recirculate.
Locate unit so that the vent air outlet hood is at least:

- Three (3) feet above any force air inlet located within 10 horizontal feet (excluding those integral to the unit).
- Four (4) feet below, four horizontal feet from, or one foot above any door or gravity air inlet into the building.
- Four (4) feet from electric and gas meters, regulators and relief equipment.

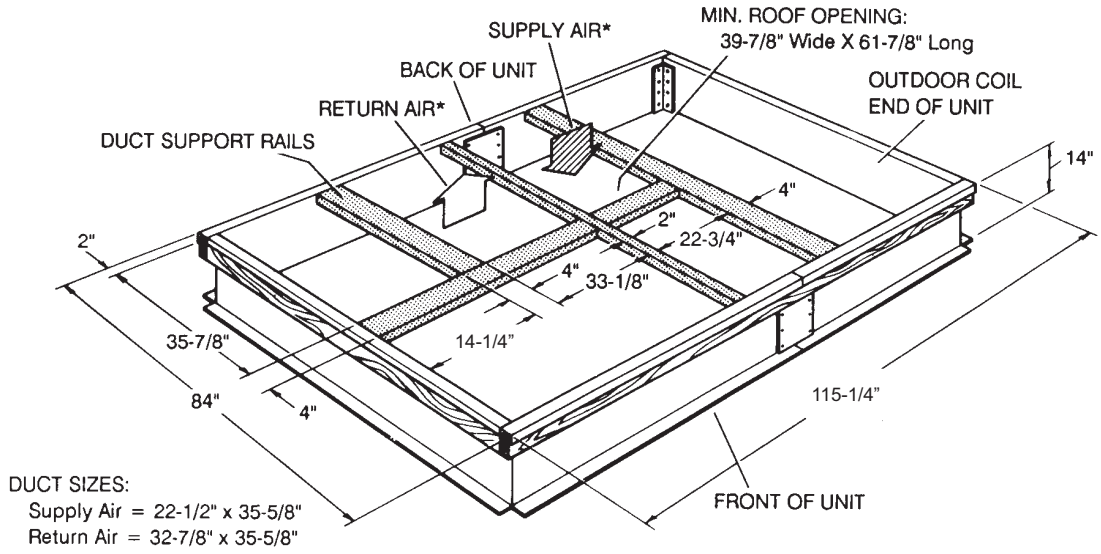


Figure 8: ZF180 Roof Curb

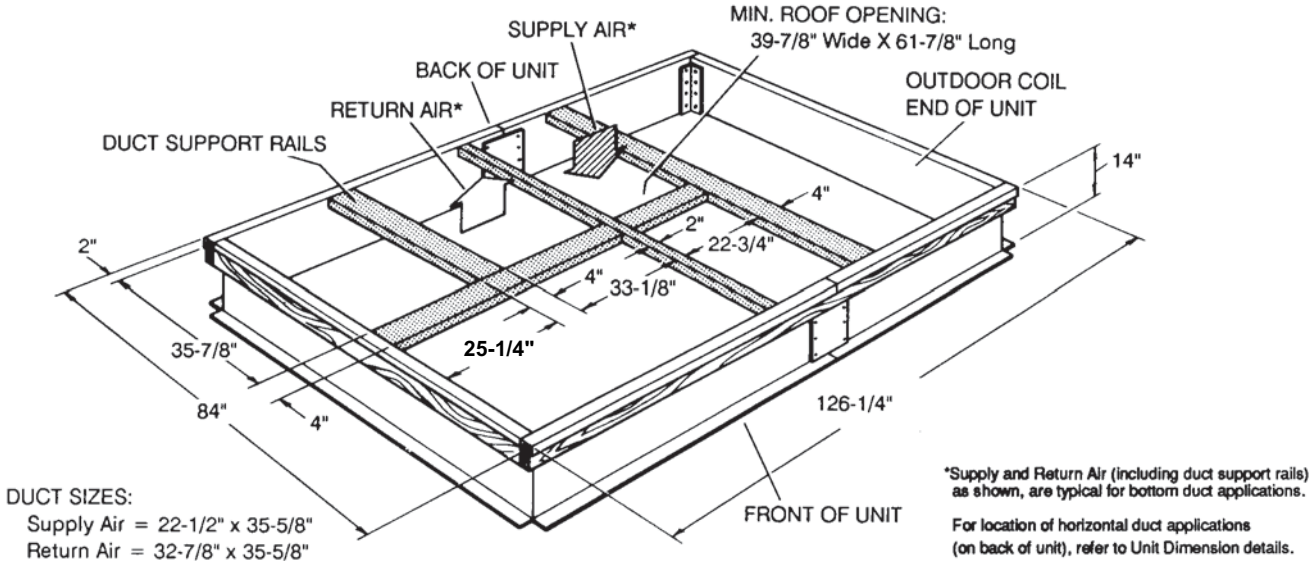


Figure 9: ZF210-300 Roof Curb

Ductwork

Ductwork should be designed and sized according to the methods in Manual D of the Air Conditioning Contractors of America (ACCA) or as recommended by any other recognized authority such as ASHRAE or SMACNA.

A closed return duct system should be used. This will not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static pressure requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

Refer to Figure 5 for bottom air duct openings. Refer to Figure 6 for side air duct openings.

NOTE: It is recommended that, in Canada, the outlet duct be provided with a removable access panel. It is recommended that this opening be accessible when the unit is installed in service, and of a size such that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover should be attached in a manner adequate to prevent leakage.

Fixed Outdoor Air Intake Damper

This damper is shipped inside the return air compartment. It is completely assembled and ready for installation. A damper baffle inside of the hood is adjustable to provide variable

amounts of outdoor air intake on units that are not provided with an economizer or a motorized damper option. Refer to the Fixed Outdoor Damper Figure 10.

Gasketing and mounting screws are provided in a parts bag attached to the hood assembly. Apply gasketing to the three flange surfaces on the hood prior to installing the hood. Extend gasketing 1/4 inch beyond the top and bottom of the two side flanges to insure adequate sealing.

Adjusting the damper to the desired air flow may be done before mounting the hood into position or after installation by removing the front hood panel or the screen on the bottom of the hood. Damper baffle in position 1 will allow approximately 10% outdoor air flow, position 2 approximately 15% and, to allow approximately 25%, remove the damper baffle.

On units with bottom return air application install the damper assembly over the opening in the side return air access panel. Remove and discard the opening cover and the covering over the hood mounting holes (used for shipping) before installing. Secure with the screws provided.

On units with side return air applications, install the damper assembly on the return air ductwork as close to the unit as possible. Cut an opening 16 inches high by 18 inches wide in the ductwork to accommodate the damper. Using the holes in the hood flanges as a template, drill 9/64 inch diameter (#26 drill) holes into the ductwork and secure with the screws provided.

⚠ CAUTION

If outdoor air intake will not be required on units with bottom return air applications, the damper assembly should still be mounted on the side return air access panel, per the instructions above, to insure moisture is not drawn into the unit during operation. The covering over the mounting holes only need be removed. Do not remove the opening cover.

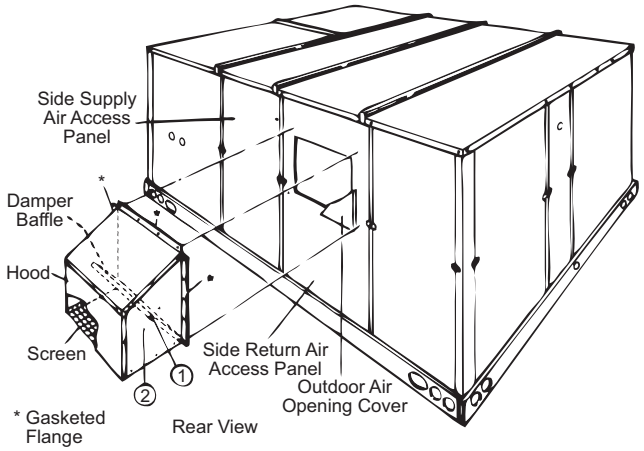


Figure 10: Fixed Outdoor Air Damper

Condensate Drain

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install a condensate drain line from the one-inch NPT female connection on the unit to an open drain.

NOTE: The condensate drain operates in a negative pressure in the cabinet. The condensate drain line MUST be trapped to provide proper drainage. See Figure 11.

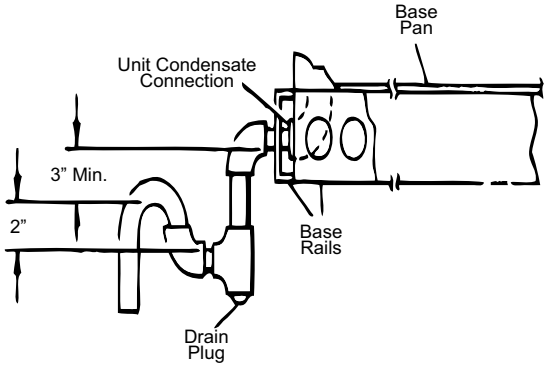


Figure 11: Condensate Drain

Compressors

The scroll compressor used in this product is specifically designed to operate with R-410A Refrigerant and cannot be interchanged.

⚠ CAUTION

This system uses R-410A Refrigerant which operates at higher pressures than R-22. No other refrigerant may be used in this system.

The compressor also uses a polyolester (POE oil), Mobil 3MA POE. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oil can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

⚠ CAUTION

Do not leave the system open to the atmosphere. Unit damage could occur due to moisture being absorbed by the **POE oil** in the system. This type of oil is highly susceptible to moisture absorption

POE (polyolester) compressor lubricants are known to cause long term damage to some synthetic roofing materials.

⚠ CAUTION

Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When performing any service that may risk exposure of compressor oil to the roof, take precautions to protect roofing.

Procedures which risk oil leakage include, but are not limited to, compressor replacement, repairing refrigerant leaks, replacing refrigerant components such as filter drier, pressure switch, metering device or coil.

Units are shipped with compressor mountings which are factory-adjusted and ready for operation.

⚠ CAUTION

Do not loosen compressor mounting bolts.

Filters

Two-inch filters are supplied with each unit, but units can be converted easily to four-inch filters. Filters must always be installed ahead of the evaporator coil and must be kept clean or replaced with same size and type. Dirty filters will reduce the capacity of the unit and will result in frosted coils or safety shutdown. Minimum filter area and required sizes are shown in Physical Data Table 9.

⚠ CAUTION

Make sure that panel latches are properly positioned on the unit to maintain an airtight seal.

Power And Control Wiring

Field wiring to the unit, fuses, and disconnects must conform to provisions of National Electrical Code (NEC), ANSI/NFPA No. 70 – Latest Edition (in U.S.A.), current Canadian Electrical Code C221, and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC as specified above and/or local codes.

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units control transformers are factory wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

Voltage tolerances which must be maintained at the compressor terminals during starting and running conditions are indicated on the unit Rating Plate and Table 1.

The internal wiring harnesses furnished with this unit are an integral part of the design certified unit. Field alteration to comply with electrical codes should not be required. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

A disconnect must be utilized for these units. Factory installed disconnects are available. If installing a disconnect (field supplied or York International® supplied accessory), refer to Figure 1 for the recommended mounting location.

⚠ CAUTION

Avoid damage to internal components if drilling holes for disconnect mounting.

NOTE: Since not all local codes allow the mounting of a disconnect on the unit, please confirm compliance with local code before mounting a disconnect on the unit.

Electrical line must be sized properly to carry the load. USE COPPER CONDUCTORS ONLY. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

Refer to Figures 12 and 13 for typical field wiring and to the appropriate unit wiring diagram mounted inside control doors for control circuit and power wiring information.

⚠ CAUTION

When connecting electrical power and control wiring to the unit, water-proof connectors must be used so that water or moisture cannot be drawn into the unit during normal operation. The above water-proofing conditions will also apply when installing a field supplied disconnect switch.

Power Wiring Detail

Units are factory wired for the voltage shown on the unit nameplate. Refer to Electrical Data Table 8 to size power wiring, fuses, and disconnect switch.

Power wiring is brought into the unit through the side of the unit or the basepan inside the curb.

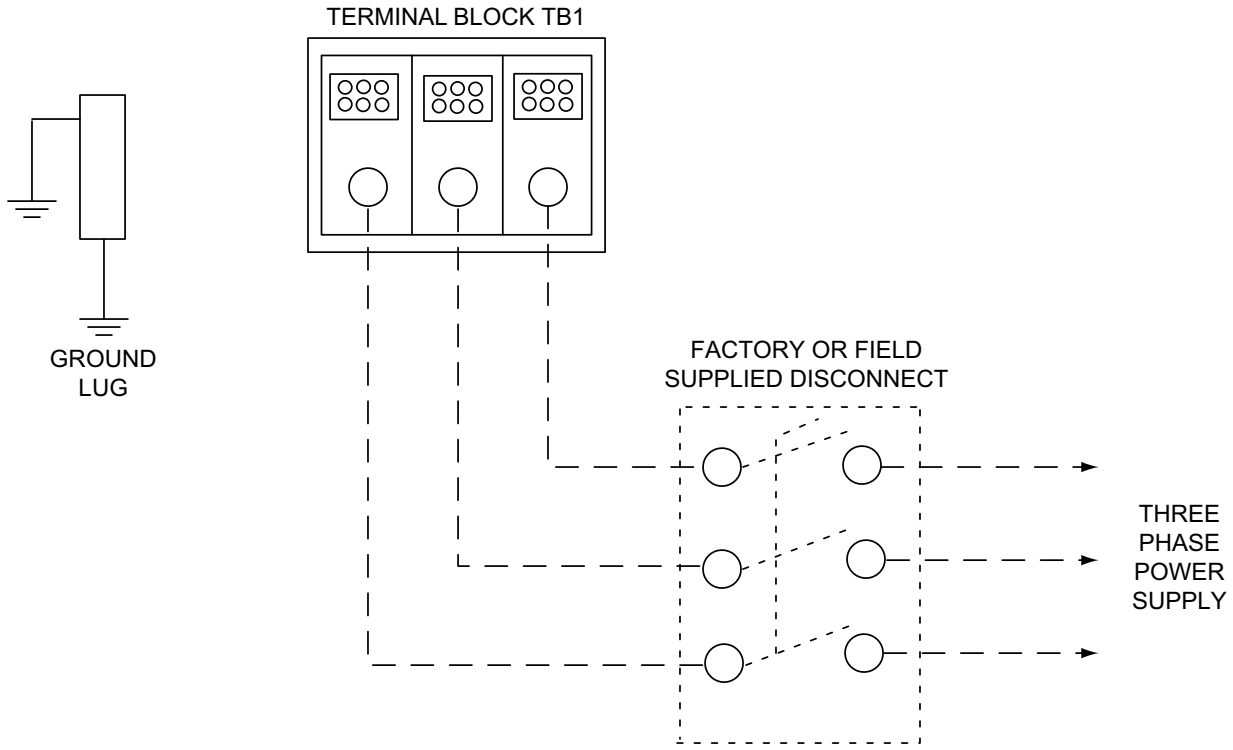


Figure 12: Field Wiring Disconnect - Cooling Unit With/Without Electric Heat

Thermostat Wiring

The thermostat should be located on an inside wall approximately 56 inch above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with thermostat for general installation procedure. Seven (7) color-coded, insulated wires should be used to connect the thermostat to the unit. Refer to Table 7 for control wire sizing and maximum length.

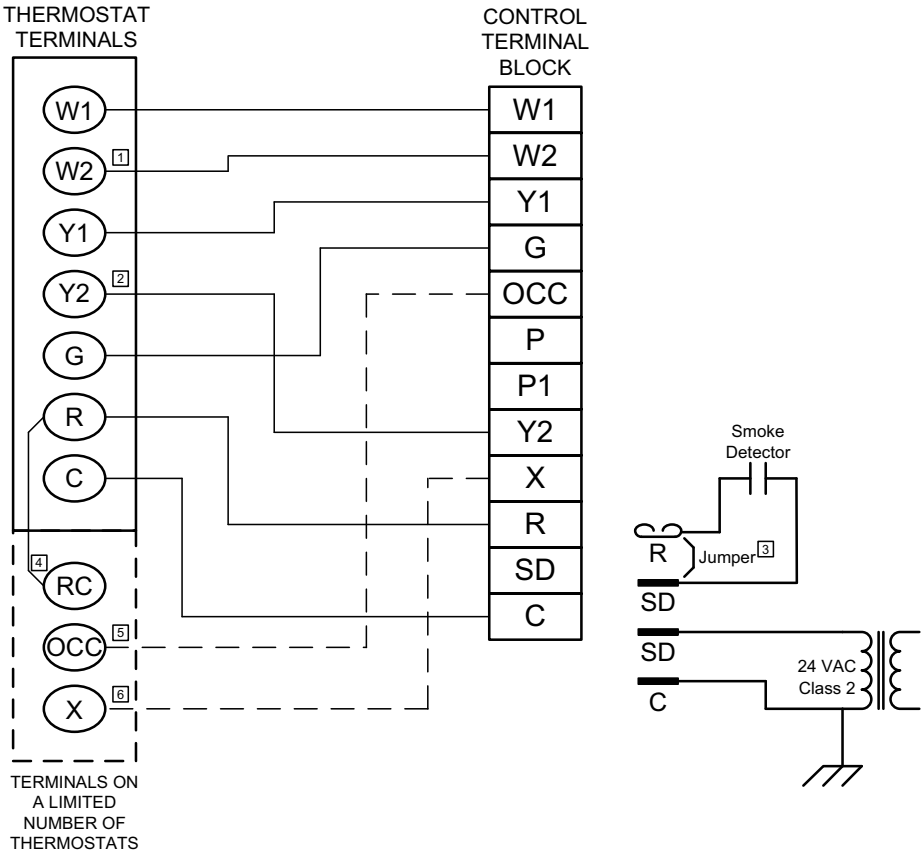
Space Sensor

The space sensor, if used, should be located on an inside wall approximately 56 inches above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow manufacturer's instructions enclosed with sensor for general installation procedure.

Table 7: Control Wire Sizes

Wire Size	Maximum Length[1]
18 AWG	150 Feet

1. From the unit to the thermostat and back to the unit.



1 Second stage heating not required on single stage heating units.

2 Second stage cooling not required on single stage cooling units.

3 Jumper is required if there is no Smoke Detector circuit.

4 Jumper is required for any combination of R, RC, or RH.

5 OCC is an output from the thermostat to indicate the Occupied condition.

6 X is an input to the thermostat to display Error Status conditions.

Figure 13: Typical Field Wiring 24 Volt Thermostat

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units control transformers are factory wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation. See unit wiring diagram.

Table 8: Electrical Data

ZF180-300 - Standard Drive Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
180 (15)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
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210 (17.5)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
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240 (20)	208-3-60	33.3	33.3	239	239	52	52	4.5	15.4	0.0	None	--	--	--	99.3	125
											E18	13.5	1	37.5	99.3	125
											E36	27	2	74.9	112.9	125
											E54	40.6	2	112.7	160.1	175
											E72	54.1	2	150.2	169.4	200
	230-3-60	33.3	33.3	239	239	52	52	4.3	14.4	0.0	None	--	--	--	97.9	125
											E18	18.0	1	43.3	97.9	125
											E36	36.0	2	86.6	126.3	150
											E54	54.0	2	129.9	147.9	175
											E72	72.0	2	173.2	191.2	225
	460-3-60	17.9	17.9	125	125	28	28	2.2	7.2	0.0	None	--	--	--	51.9	60
											E18	18.0	1	21.7	51.9	60
											E36	36.0	2	43.3	63.1	70
											E54	54.0	2	65.0	74.0	90
											E72	72.0	2	86.6	95.6	110
	575-3-60	12.8	12.8	80	80	20	20	1.7	5.9	0.0	None	--	--	--	38.1	50
											E18	18.0	1	17.3	38.1	50
											E36	36.0	2	34.6	50.7	60
											E54	54.0	2	52.0	59.3	70
											E72	72.0	2	69.3	76.7	90

ZF180-300 - Standard Drive Without Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
300 (25)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
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1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZF180-300 - Standard Drive With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
180 (15)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
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240 (20)	208-3-60	33.3	33.3	239	239	52	52	4.5	15.4	10.0	None	--	--	--	109.3	125
											E18	13.5	1	37.5	109.3	125
											E36	27	2	74.9	125.4	150
											E54	40.6	2	112.7	172.6	175
											E72	54.1	2	150.2	181.9	200
	230-3-60	33.3	33.3	239	239	52	52	4.3	14.4	10.0	None	--	--	--	107.9	125
											E18	18.0	1	43.3	107.9	125
											E36	36.0	2	86.6	138.8	150
											E54	54.0	2	129.9	160.4	175
											E72	72.0	2	173.2	203.7	225
	460-3-60	17.9	17.9	125	125	28	28	2.2	7.2	5.0	None	--	--	--	56.9	70
											E18	18.0	1	21.7	56.9	70
											E36	36.0	2	43.3	69.4	70
											E54	54.0	2	65.0	80.2	90
											E72	72.0	2	86.6	101.9	110
	575-3-60	12.8	12.8	80	80	20	20	1.7	5.9	4.0	None	--	--	--	42.1	50
											E18	18.0	1	17.3	42.1	50
											E36	36.0	2	34.6	55.7	60
											E54	54.0	2	52.0	64.3	70
											E72	72.0	2	69.3	81.7	90

ZF180-300 - Standard Drive With Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
300 (25)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
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1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZF180-300 - Hi Static Drive Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
180 (15)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
210 (17.5)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
240 (20)	208-3-60	33.3	33.3	239	239	52	52	4.5	20.0	0.0	None	--	--	--	103.9	125
											E18	13.5	1	37.5	103.9	125
											E36	27	2	74.9	118.7	125
											E54	40.6	2	112.7	165.9	175
											E72	54.1	2	150.2	175.2	200
	230-3-60	33.3	33.3	239	239	52	52	4.3	20.0	0.0	None	--	--	--	103.5	125
											E18	18.0	1	43.3	103.5	125
											E36	36.0	2	86.6	133.3	150
											E54	54.0	2	129.9	154.9	175
											E72	72.0	2	173.2	198.2	225
	460-3-60	17.9	17.9	125	125	28	28	2.2	10.0	0.0	None	--	--	--	54.7	70
											E18	18.0	1	21.7	54.7	70
											E36	36.0	2	43.3	66.6	70
											E54	54.0	2	65.0	77.5	90
											E72	72.0	2	86.6	99.1	110
	575-3-60	12.8	12.8	80	80	20	20	1.7	8.2	0.0	None	--	--	--	40.4	50
											E18	18.0	1	17.3	40.4	50
											E36	36.0	2	34.6	53.6	60
											E54	54.0	2	52.0	62.2	70
											E72	72.0	2	69.3	79.5	90

ZF180-300 - Hi Static Drive Without Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
300 (25)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZF180-300 - Hi Static Drive With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
180 (15)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
210 (17.5)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
240 (20)	208-3-60	33.3	33.3	239	239	52	52	4.5	20.0	10.0	None	--	--	--	113.9	125
											E18	13.5	1	37.5	113.9	125
											E36	27	2	74.9	131.2	150
											E54	40.6	2	112.7	178.4	200
											E72	54.1	2	150.2	187.7	200
	230-3-60	33.3	33.3	239	239	52	52	4.3	20.0	10.0	None	--	--	--	113.5	125
											E18	18.0	1	43.3	113.5	125
											E36	36.0	2	86.6	145.8	150
											E54	54.0	2	129.9	167.4	175
											E72	72.0	2	173.2	210.7	225
	460-3-60	17.9	17.9	125	125	28	28	2.2	10.0	5.0	None	--	--	--	59.7	70
											E18	18.0	1	21.7	59.7	70
											E36	36.0	2	43.3	72.9	80
											E54	54.0	2	65.0	83.7	90
											E72	72.0	2	86.6	105.4	110
	575-3-60	12.8	12.8	80	80	20	20	1.7	8.2	4.0	None	--	--	--	44.4	50
											E18	18.0	1	17.3	44.4	50
											E36	36.0	2	34.6	58.6	60
											E54	54.0	2	52.0	67.2	70
											E72	72.0	2	69.3	84.5	90

ZF180-300 - Hi Static Drive With Powered Convenience Outlet (Continued)

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
300 (25)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZF180-300 - Low Static Drive Without Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
300 (25)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

ZF180-300 - Low Static Drive With Powered Convenience Outlet

Size (Tons)	Volt	Compressors (each)						OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA		LRA		MCC		FLA	FLA	FLA	Model	kW	Stages	Amps		
		C1	C2	C1	C2	C1	C2									
300 (25)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD
											TBD	TBD	TBD	TBD	TBD	TBD

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

Table 9: ZF180-300 Physical Data

Component	Models							
	ZF180		ZF210		ZF240		ZF300	
Nominal Tonnage	**15**		**17.5**		**20**		**25**	
AHRI COOLING PERFORMANCE								
Gross Capacity @ AHRI A point (K Btu)	TBD		TBD		254.5		TBD	
AHRI net capacity (K Btu)	TBD		TBD		246.5		TBD	
EER	TBD		TBD		10.0		TBD	
SEER	TBD		TBD		-		TBD	
IEER	TBD		TBD		11.0		TBD	
Nominal CFM	TBD		TBD		8000		TBD	
System power (KW)	TBD		TBD		24.7		TBD	
Refrigerant type	TBD		TBD		R-410a		TBD	
Refrigerant charge (lb-oz)								
System 1	TBD		TBD		22		TBD	
System 2	TBD		TBD		23-8		TBD	
AHRI HEATING PERFORMANCE								
Heating model	TBD	TBD	TBD	TBD	24	32	TBD	TBD
Heat input (K Btu)	TBD	TBD	TBD	TBD	300	400	TBD	TBD
Heat output (K Btu)	TBD	TBD	TBD	TBD	240	320	TBD	TBD
AFUE%	TBD	TBD	TBD	TBD	-	-	TBD	TBD
Steady state efficiency (%)	TBD	TBD	TBD	TBD	80	80	TBD	TBD
No. burners	TBD	TBD	TBD	TBD	6	8	TBD	TBD
No. stages	TBD	TBD	TBD	TBD	2	2	TBD	TBD
Temperature Rise Range (ºF)	TBD	TBD	TBD	TBD	20-50	30-60	TBD	TBD
Gas Limit Setting (ºF)	TBD	TBD	TBD	TBD	195	195	TBD	TBD
Gas piping connection (in.)	TBD	TBD	TBD	TBD	1	1	TBD	TBD
DIMENSIONS (inches)								
Length	TBD		TBD		136-1/4		TBD	
Width	TBD		TBD		92		TBD	
Height	TBD		TBD		52-5/8		TBD	
OPERATING WT. (lbs.)	1870		TBD		2533		TBD	
COMPRESSORS								
Type	TBD		TBD		Scroll		TBD	
Quantity	TBD		TBD		2		TBD	
Unit Capacity Steps (%)	TBD		TBD		50 / 100		TBD	
CONDENSER COIL DATA								
Face area (Sq. Ft.)	TBD		TBD		43.3		TBD	
Rows	TBD		TBD		3		TBD	
Fins per inch	TBD		TBD		15		TBD	
Tube diameter (in.)	TBD		TBD		3/8		TBD	
Circuitry Type	TBD		TBD		Split-face		TBD	
EVAPORATOR COIL DATA								
Face area (Sq. Ft.)	TBD		TBD		20		TBD	
Rows	TBD		TBD		4		TBD	
Fins per inch	TBD		TBD		13.5		TBD	
Tube diameter	TBD		TBD		3/8		TBD	
Circuitry Type	TBD		TBD		Intertwined		TBD	
Refrigerant control	TBD		TBD		TXV		TBD	

Table 9: ZF180-300 Physical Data (Continued)

Component	Models								
	ZF180		ZF210		ZF240		ZF300		
Nominal Tonnage	15		17.5		20		25		
CONDENSER FAN DATA									
Quantity	TBD		TBD		2		TBD		
Fan diameter (Inch)	TBD		TBD		30		TBD		
Type	TBD		TBD		Prop		TBD		
Drive type	TBD		TBD		Direct		TBD		
No. speeds	TBD		TBD		1		TBD		
Number of motors	TBD		TBD		2		TBD		
Motor HP each	TBD		TBD		1.25		TBD		
RPM	TBD		TBD		1140		TBD		
Nominal total CFM	TBD		TBD		7000		TBD		
BELT DRIVE EVAP FAN DATA									
Quantity	TBD		TBD		1		TBD		
Fan Size (Inch)	TBD		TBD		18 X 15		TBD		
Type	TBD		TBD		Centrifugal		TBD		
Motor Sheave	TBD	TBD	TBD	TBD	1VP60	1VP60	TBD	TBD	TBD
Blower Sheave	TBD	TBD	TBD	TBD	BK110	BK090	TBD	TBD	TBD
Belt	TBD	TBD	TBD	TBD	BX78	BX75	TBD	TBD	TBD
Motor HP each	TBD	TBD	TBD	TBD	5	7.5	TBD	TBD	TBD
RPM	TBD	TBD	TBD	TBD	1725	1725	TBD	TBD	TBD
Frame size	TBD	TBD	TBD	TBD	184T	213T	TBD	TBD	TBD
FILTERS									
Quantity - Size	TBD)		TBD		4 - (16 x 25 x 2),		TBD		
	TBD		TBD		4 - (16 x 20 x 2)[1,2]		TBD		
	TBD		TBD		4 - (16 x 25 x 4),		TBD		
	TBD		TBD		4 - (16 x 20 x 4)[3]		TBD		

1. 2 In. Throwaway, Standard, MERV (Minimum Efficiency Reporting Value) 3.
2. 2 In. Pleated, Optional, MERV 7.
3. 4 In. Pleated, Optional, MERV 13.

Optional Electric Heat

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending in to the supply air chamber.

Fuses are supplied, where required, by the factory. Some kW sizes require fuses and others do not. refer to Table 10 for minimum CFM limitations and to Table 8 for electrical data.

Table 10: Electric Heat Minimum Supply Air

Size (Tons)	Voltage	Minimum Supply Air (CFM)			
		Heater kW			
		9	18	54	72
180 (15)	208/230-3-60	4500	4500	5000	5000
	460-3-60	4500	4500	5000	4500
	600-3-60	4500	4500	4500	4500
210 (17.5)	208/230-3-60	6000	6000	6000	6000
	460-3-60	6000	6000	6000	6000
	600-3-60	6000	6000	6000	6000
240 (20)	208/230-3-60	6000	6000	6000	6000
	460-3-60	6000	6000	6000	6000
	600-3-60	6000	6000	6000	6000
300 (25)	208/230-3-60	7500	7500	7500	7500
	460-3-60	7500	7500	7500	7500
	600-3-60	7500	7500	7500	7500

Optional Gas Heat

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot.

Table 11: Gas Application Data

Unit		Input (MBH)	Output (MBH)	Temp Rise (°F)[1]
Size	Opt.			
180	24	300	240	20-50
	32	400	320	30-60
210	24	300	240	20-50
	32	400	320	30-60
240	24	300	240	20-50
	32	400	320	30-60
300	24	300	240	20-50
	32	400	320	30-60

1. On VAV units, individual VAV boxes must be full open in heating mode to insure airflow falls within temperature rise range.

Gas Piping

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. “National Fuel Gas Code” Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 12. The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

NOTE: There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a one-inch pipe connection at the entrance fitting.

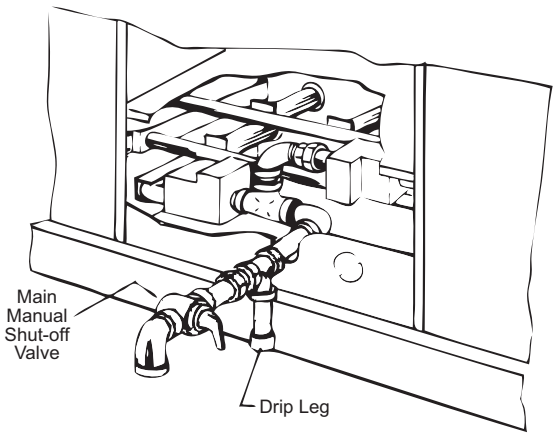

Figure 14: External Supply Connection External Shut-Off

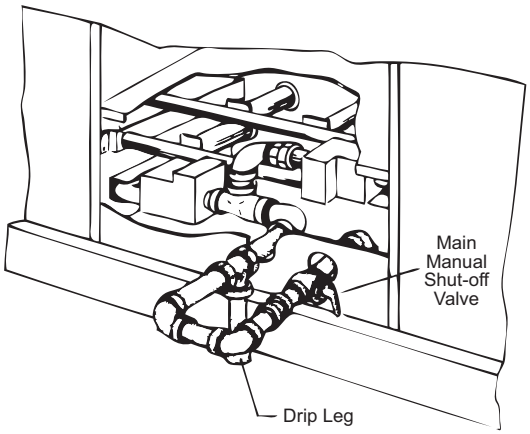

Figure 15: Bottom Supply Connection External Shut-Off

Table 12: Gas Pipe Sizing - Capacity of Pipe

Length of Pipe (ft.)	Nominal Iron Pipe Size	
	1 in.	1-1/4 in.
10	520	1050
20	350	730
30	285	590
40	245	500
50	215	440
60	195	400
70	180	370
80	170	350
90	160	320
100	150	305

NOTE: Maximum capacity of pipe in cubic feet of gas per hour based upon a pressure drop of 0.3 inch W.C. and 0.6 specific gravity gas.

Table 13: Gas Heat Minimum Supply Air

Size (Tons)	Heat Size	Supply Air (CFM)			
		Cooling		Heating	
		Min	Max	Min	Max
180	24	4500	7000	4500	7000
(15)	32	4500	7000	4500	7000
210	24	6000	8750	6000	8750
(17.5)	32	6000	8750	6000	8750
240	24	6000	9400	6000	9400
(20)	32	6000	9400	6000	9400
300	24	7500	12500	7500	12500
(25)	32	7500	12500	7500	12500

Gas Connection

The gas supply line can be routed within the space and roof curb, exiting through the unit's basepan. Refer to Figure 5 for the gas piping inlet location. Typical supply piping arrangements are shown in Figures 14 and 15. All pipe nipples, fittings, and the gas cock are field supplied.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.
2. Where required by local codes, a manual shut-off valve must be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe dope should be applied sparingly to male threads only.

⚠WARNING

Natural gas may contain some propane. Propane is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe. Shellac based compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clydes's or John Crane may be used.

4. All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out loose particles. Before initial start-up, be sure that all gas lines external to the unit have been purged of air.
5. The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under "Limitations".
6. A 1/8-inch NPT plugged tapping, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the unit.
7. After the gas connections have been completed, open the main shut-off valve admitting *normal gas pressure* to the mains. *Check all joints for leaks with soap solution or other material suitable for the purpose.* **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠CAUTION

The furnace and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures in excess of 1/2 PSIG.

Pressures greater than 1/2 PSIG will cause gas valve damage resulting in a hazardous condition. If it is subjected to a pressure greater than 1/2 PSIG, the gas valve must be replaced.

The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG.

⚠WARNING

Threaded joints should be coated with a sealing compound that is resistant to the action of liquefied petroleum gases. **Do not use Teflon tape.**

Lp Units, Tanks And Piping

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with LP gas with accessory kit model number 1NP0418.

All LP gas equipment must conform to the safety standards of the National Fire Protection Association.

For satisfactory operation, LP gas pressure must be 10.0 inch W.C. at the unit under full load. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate which depends on the temperature of the liquid and the "wetted surface" area of the container(s).
2. The proper pressure regulation. (Two-stage regulation is recommended).
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required will depend on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and LP gas suppliers.

⚠WARNING

LP gas is an excellent solvent and will quickly dissolve white lead and most standard commercial compounds. A special pipe dope must be used when assembling wrought iron or steel pipe for LP. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde's, or John Crane may be used.

Check all connections for leaks when piping is completed using a soap solution. **NEVER USE A FLAME.**

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

Vent And Combustion Air

Two vent hoods and a combustion air hood (with screens) are shipped attached to the blower housing in the blower compartment. For units with factory installed VFD option, the hoods and accompanying hardware are shipped inside the gas heat section. These hoods must be installed to assure proper unit function. All hoods must be fastened to the outside of the gas heat access panel with the screws provided in the bag also attached to the blower housing.

The screen for the combustion air intake hood is secured to the inside of the access panel opening with four fasteners and the screws used for mounting the hood to the panel. The top flange of this hood slips in under the top of the access panel opening when installing. Refer to Vent and Combustion Air Hood Figure 16.

Each vent hood is installed by inserting the top flange of the hood into the slotted opening in the access panel and securing in place.

The products of combustion are discharged horizontally through these two screened, hooded vent openings on the upper gas heat access panel.

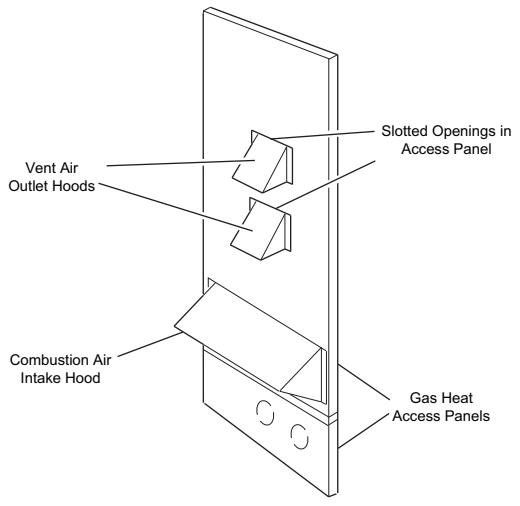

Figure 16: Vent and Combustion Air Hood

Options/Accessories

Electric Heat

Electric heaters are available as a factory-installed option. These heaters mount in the heat compartment with the heating elements extending into the supply air chamber. All electric heaters are fused and intended for use with single point power supply.

Economizer/Motorized Outdoor Damper Rain Hood

The instruction for the optional economizer/motorized damper rain hood can be found in the rain hood kit. Use these instructions when field assembling an economizer rain hood onto a unit. The outdoor and return air dampers, the damper actuator, the damper linkage, the outdoor and return air divider baffles, and all the control sensors are factory mounted as part of the “Factory installed” economizer option.

Power Exhaust/Barometric Relief Damper and Rain Hood

The instructions for the power exhaust/barometric relief damper and rain hood can be found in the rain hood kit. The exhaust fan, all supporting brackets, angles, and the wiring are factory installed as part of the power exhaust option.

Economizer And Power Exhaust Set Point Adjustments

Remove the top rear access panel from the unit. Locate the economizer control module, where the following adjustments will be made.

⚠ CAUTION

Extreme care must be exercised in turning all set point, maximum and minimum damper positioning adjustment screws to prevent twisting them off.

Minimum Position Adjustment

- Check that the damper blades move smoothly without binding; carefully turn the Minimum Position Adjust screw (found on the damper control module) fully clockwise and then set the thermostat indoor fan switch to the ON position and then OFF or energize and de-energize terminals “R” to “G”.
- With the thermostat set to the indoor fan ON position or terminals “R” to “G” energized, turn the Minimum Position Adjusting screw (located on the damper control module) counterclockwise until the desired minimum damper position has been attained.

Enthalpy Set Point Adjustment

- The enthalpy set point may now be set by selecting the desired set point shown in the Enthalpy Set Point Adjustment Figure 17. Adjust as follows:
- For a single enthalpy operation carefully turn the set point adjusting screw (found on the damper control

module) to the “A”, “B”, “C” or “D” setting corresponding to the lettered curve of the Enthalpy Set Point Adjustment Figure 18.

- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the "D" setting.

Power Exhaust Damper Set Point

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer damper position (Percent Open). The Exhaust Air Adjustment Screw should be set at the Percent Open of the economizer damper at which the power exhaust is needed. It can be set from 0 to 100% damper open.

Indoor Air Quality AQ

Indoor Air Quality (indoor sensor input): Terminal AQ accepts a +2 to +10 Vdc signal with respect to the (AQ1) terminal. When the signal is below it's set point, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the AQ signal exceeds it's set point setting and there is no call for free cooling, the actuator is proportionately modulated from the 2 to 10 Vdc signal, with 2 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds it's set point (Demand Control Ventilation Set Point) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the AQ voltage input.

- Optional CO_2 Space Sensor Kit Part # 2AQ04700324
- Optional CO_2 Sensor Kit Part # 2AQ04700424

Replace the top rear access panel on the unit.

Optional BAS-Ready Economizer Power Exhaust Damper Set Point Adjustment

Remove the economizer access panel from the unit. Loosen, but do not remove the two panel latches. Locate the economizer actuator, where the following adjustment can be made.

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer's outdoor damper position. The actuator's auxiliary switch adjustment screw should be set at the damper position at which the power exhaust is needed. The adjustment screw can be set between 25 to 85 degrees open.

Replace the economizer access panel.

Optional Variable Air Volume (VAV)

A variable air volume (VAV) option using a variable frequency drive (VFD) is available for applications requiring a constant supply duct static pressure. A differential pressure transducer is used to monitor supply duct static pressure and return a speed reference signal to the VFD to control the output of the indoor blower motor.

Duct Static Pressure Transducer

A 0-5" WC pressure transducer, located in the control box compartment, is used to sense static (gauge) pressure in the supply air duct and convert this pressure measurement to a proportional 0-5 VDC electrical output.

Pressure-transmitting plastic tubing (1/4" diameter) must be field supplied and installed from the transducer to both the ductwork and to the atmosphere. Connect the tubing from the 'HIGH' pressure tap of the transducer to a static pressure tap (field supplied) in the supply duct located at a point where constant pressure is expected. To prevent an unstable signal due to air turbulence, there should be no obstructions, turns or VAV terminal boxes up- or down-stream of the sensing tube location for at least a distance of 6-10 times the duct diameter. Tubing must also be run between the 'LOW' pressure tap of the transducer and atmospheric pressure (outside of the unit).

⚠ CAUTION

Do not run plastic tubing in the supply or return air ducts as air movement could cause erroneous pressure measurements. If the tubing penetrates through the bottom of the unit be sure openings are sealed to prevent air and water leakage.

VAV Control Board

A VAV control board, located in the top-left corner of the control box, is used to convert the pressure transducer input signal into a speed reference signal that the drive uses to control the speed of the blower motor. This modulating speed reference signal is generated using an internal algorithm which continuously calculates an output value.

A brief description of the VAV board's I/O terminals that are used follows:

Inputs:

- **DUCT PRES** - a 0-5 VDC analog input provided by a factory-installed duct static pressure transducer located in the unit's control box.
- **SAT -** analog input provided by a factory-installed 10k-ohm, type 3 thermistor located in the unit's supply air compartment.
- **RAT -** analog input provided by a factory-installed 10k-ohm, type 3 thermistor located in the unit's return air compartment.
- **OAT -** analog input provided by a factory-installed 10k-ohm, type 3 thermistor located in the outdoor air compartment or mounted within the evaporator base rail for units without the installed economizer option.
- **ST -** analog input provided by field-installed space temperature sensor.

- **OH -** a 0-10 VDC analog input provided by a field-installed outdoor air relative humidity sensor for single enthalpy economizer configuration.
- **RH -** a 0-10 VDC analog input provided by a field-installed return air relative humidity sensor for dual enthalpy economizer configuration (used with OH).
- **IAQ -** a 0-10 VDC analog input provided by a field-installed carbon dioxide sensor which monitors indoor air quality (CO2 concentration) and enables call for Demand Ventilation mode for units installed with economizer option.
- **OAQ -** a 0-10 VDC analog input provided by a field-installed carbon dioxide sensor which monitors outdoor air quality (CO2 concentration) and, along with IAQ, enables call for Differential Demand Ventilation mode for units installed with economizer option.
- **APS -** a 24 VAC binary input provided by a field-installed air proving switch which monitors the pressure difference across the indoor blower.
- **PUR -** a 24 VAC binary input for building purge calls from an external source.
- **OCC -** a 24 VAC binary input used to set the building occupancy status for the control.
- **LIMIT 2 -** a 24 VAC binary input which either confirms 2nd-stage gas heat operation or receives an error signal from the variable frequency drive.

Outputs:

- **FAN -** a 2-10 VDC analog output signal sent to the VFD to modulate the speed of the indoor blower motor.
- **ECON -** a 2-10 VDC analog output signal sent to the economizer actuator to modulate position of the return air and outdoor air dampers (optional).
- **EXH ~ -** a 24 VAC binary output signal used to turn on/off the power exhaust relay (optional).
- **VAV BOX (gas/electric heat only) -** a normally open relay contact connected to a terminal block, used to drive the building's VAV boxes to full-open during heating operation.

Programmable set points:

The *duct static set point* is the pressure that the drive will maintain when operating the unit in VAV mode. The set-point is adjustable between 0" WC and 5" WC with the default setting of 1.5" WC.

The *duct static high-limit set point* is the maximum allowable duct pressure to prevent damage from over-pressurization of the ductwork in the event of either a drive or damper failure. The high-limit set-point is adjustable between 0" WC and 5" WC with the factory default setting of 4.5" WC. If the duct static pressure reaches the high-limit set point, then the supply fan motor will be shutdown.

NOTE: Either of the set points described above can be changed through the unit control board (UCB) with the use of a USB-to-RS485 converter, personal computer or PDA and a down-loaded copy of the Simplicity® software available at www.yorkupg.com.

⚠ CAUTION

The customer must be aware of the duct pressure design limit, and what the duct pressure sensor is reading when the peak pressure is reached (i.e. the pressure transducer sensing tube may not be located at the place of highest pressure in the system).

Factory-installed VFD

The factory-installed VFD is mounted in the Blower Access Compartment above the blower assembly. The drive comes wired from the factory to include both 3-phase power and control connections (run permit signal, speed reference signal & fault signal).

All required drive parameters are pre-programmed at the factory, except in the case of 208-volt applications, in which the parameter that defines motor nameplate voltage must be changed to a value of 208.00 and the parameter that defines motor-rated current must be changed to the appropriate value appearing on the motor's nameplate. Refer to the enclosed drive material or access the UPGnet Commercial Product Catalog website for instructions on changing parameter settings.

For units also equipped with gas/electric heat, a terminal block located in the unit's control box and connected to the VAV board's "VAV BOX" terminal, must be field wired to the building's VAV boxes to ensure fully open dampers during heating operation.

Manual Bypass

An optional, factory-installed manual bypass switch available with factory-installed VFD can be found in the Blower Motor Access compartment and has the following three positions:

- **DRIVE** - routes power through the VFD for modulating control of the indoor blower motor.
- **LINE** (or BYPASS) - routes power directly to the motor which provides full-speed motor operation and complete electrical isolation of the drive.
- **TEST** - routes power to the VFD but not to the motor to allow for drive programming and/or diagnostics.

If a drive failure occurs, the unit does not automatically switch to bypass mode. The LINE/DRIVE/TEST switch must be manually switched to the LINE (BYPASS) position. If there is a call for the fan, the indoor blower motor will run at full-speed while in the bypass mode.

⚠ CAUTION

If the unit is operated with the manual bypass switch in the LINE (BYPASS) position and there are VAV boxes present in the duct system, then boxes must be driven to the full-open position using a customer-supplied power source to prevent over-pressurizing and possible damage to the ductwork.

⚠ WARNING

Before beginning any service, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

BAS-Ready VFD

Factory-installed VFD is also available with 'BAS-ready' models. Terminal blocks are provided in the control box (in place of the VAV control board) for field wiring of a customer-installed BAS to receive 24 VAC power and to connect to the following control signals:

- a duct static pressure transducer input signal (0-5 VDC)
- an economizer actuator input signal (2-10 VDC)
- an economizer actuator output signal (2-10 VDC)
- a VFD speed reference output signal (2-10 VDC)

The use of shielded cable is recommended for the above control wiring connections.

NOTE: Factory-installed VFD is not available with factory-installed BAS options due to space limitations in the control box.

A solid-state, lock-out relay (LR) and 100-µF, 50 VDC capacitor must be field-supplied and installed to provide a means to transmit a potential fault signal back to the BAS controller. The specific relay part number required will depend upon the need for either AC-output or DC-output. See price pages for further details.

Once the appropriate relay and capacitor are obtained, install the capacitor across LR terminals '3' & '4' and make the following wiring connections:

- LR '1' to BAS controller
- LR '2' to BAS controller
- LR '3' to UCB 'X'
- LR '4' to UCB 'C'

'VFD-Ready' For Customer-installation

Units configured as 'VFD-ready' provide provisions for a customer-installed drive. The physical dimensions of VFDs can vary greatly among manufacturers, horsepower ratings and voltage requirements. Keep in mind that drive manufacturers also require various minimum clearances to allow for adequate internal cooling of the drive during operation.

The unit comes with a mounting bracket installed in the Blower Access compartment which may accommodate other vendor's drives depending on their size. In order to utilize the unit's mounting bracket, the maximum recommended drive dimensions are as follows:

For 5-hp motor applications ..... 13" H x 6" W x 7" D
For 7.5 thru 15-hp motor applications..... 13" H x 8" W x 8" D

If the drive will not fit in the allotted space, then it will need to be mounted elsewhere; either within the building on a perpendicular wall which is not subjected to excessive temperature, vibration, humidity, dust, corrosive gas, explosive gas, etc., or within an appropriate enclosure rated for outside installation to safeguard against moisture, dust and excessive heat.

The power leads to the drive (L1, L2, L3) and from the motor (T1, T2, T3) along with the respective ground wires are supplied with the unit and need to be connected after the drive is installed.

⚠ CAUTION

Do not connect AC power to the T1, T2, T3 drive terminals to prevent damage to the VFD.

A terminal block located in the control box is provided for field connection of the VFD speed reference signal (2-10 VDC) and to the normally-open, run-permit auxiliary contact. The use of shielded cable is recommended for the above control wiring connections.

For VFD-ready units also equipped with gas/electric heat, a terminal block located in the unit's control box and connected to the VAV board's "VAV BOX" terminal, must be field wired to the building's VAV boxes to ensure fully open dampers during heating operation.

Optional Hot Gas Bypass (HGBP)

To allow for low cooling load operation, a direct-acting, pressure-modulating bypass control valve installed on the system #1 discharge line is used to divert high temperature, high pressure refrigerant around the TXV in order to maintain a desired minimum evaporator pressure.

The opening pressure of the bypass valve is fully adjustable between 0 and 80 psig with a factory-setting of 60 psig. HGBP is standard on all units with VAV and optional with CV units.

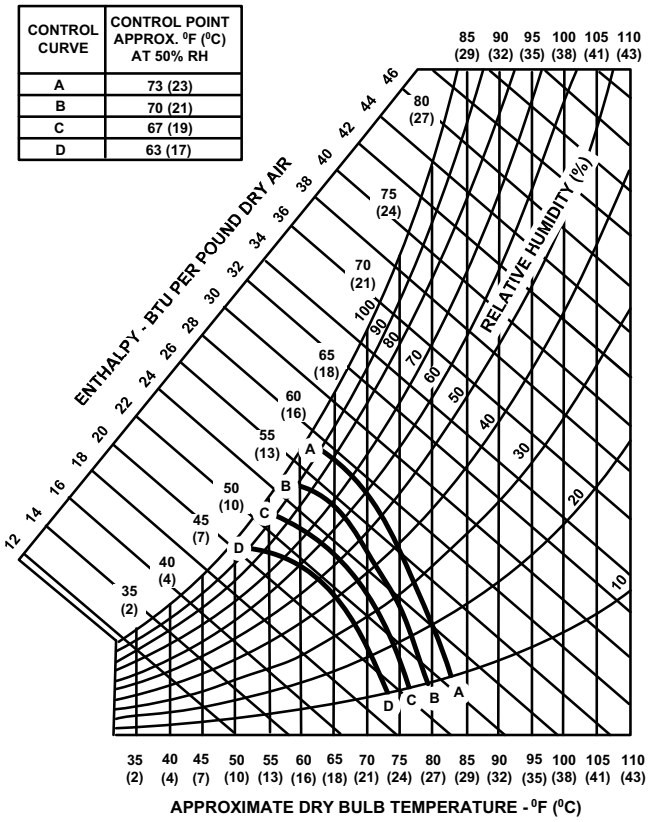
CONTROL CURVE
CONTROL POINT APPROX. 0F (0C) AT 50% RH
A 73 (23)
B 70 (21)
C 67 (19)
D 63 (17)
ENTHALPY - BTU PER POUND DRY AIR
RELATIVE HUMIDITY (%)
APPROXIMATE DRY BULB TEMPERATURE - 0F (0C)

Figure 17: Enthalpy Set Point Chart

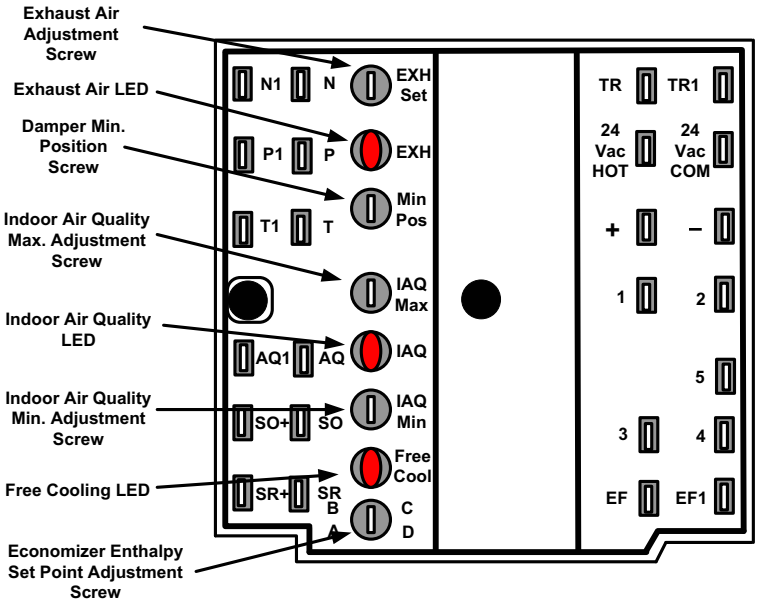

Figure 18: Honeywell Economizer Control W7212

Phasing

York® Model ZF units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the phasing of the **Field Line Connection at the factory or field supplied disconnect** to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased.)

⚠ CAUTION

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower condenser fans, or compressor rotate correctly.

Blower Rotation

Check for proper supply air blower rotation. If the blower is rotating backwards, the line voltage at the unit point of power connection is misphased (See 'PHASING').

Belt Tension

The tension on the belt should be adjusted as shown in Figure 19.

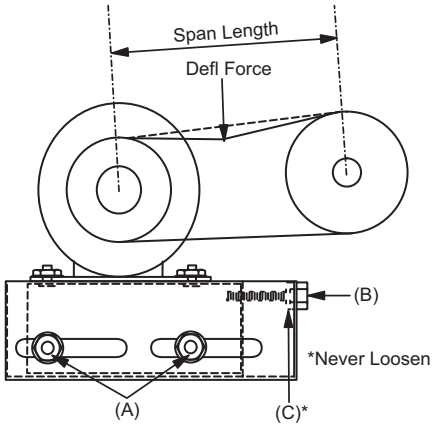

Figure 19: Belt Adjustment

⚠ CAUTION

Procedure for adjusting belt tension:

1. Loosen six nuts (top and bottom) A.
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. Deflection distance of 4mm (5/32") is obtained.

To determine the deflection distance from normal position, use a straight edge from sheave to sheave as reference line. The recommended deflection force is as follows:

Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any retensioning should fall between the min. and max. deflection force values.

5. After adjusting retighten nuts (A).

CFM Static Pressure and Power-Altitude and Temperature Corrections

The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases. In order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

A centrifugal fan is a "constant volume" device. This means that, if the rpm remains constant, the CFM delivered is the same regardless of the density of the air. However, since the air at high altitude is less dense, less static pressure will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 14 and Figure 20.

Table 14: Altitude/Temperature Correction Factors

Air Temp.	Altitude (Ft.)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

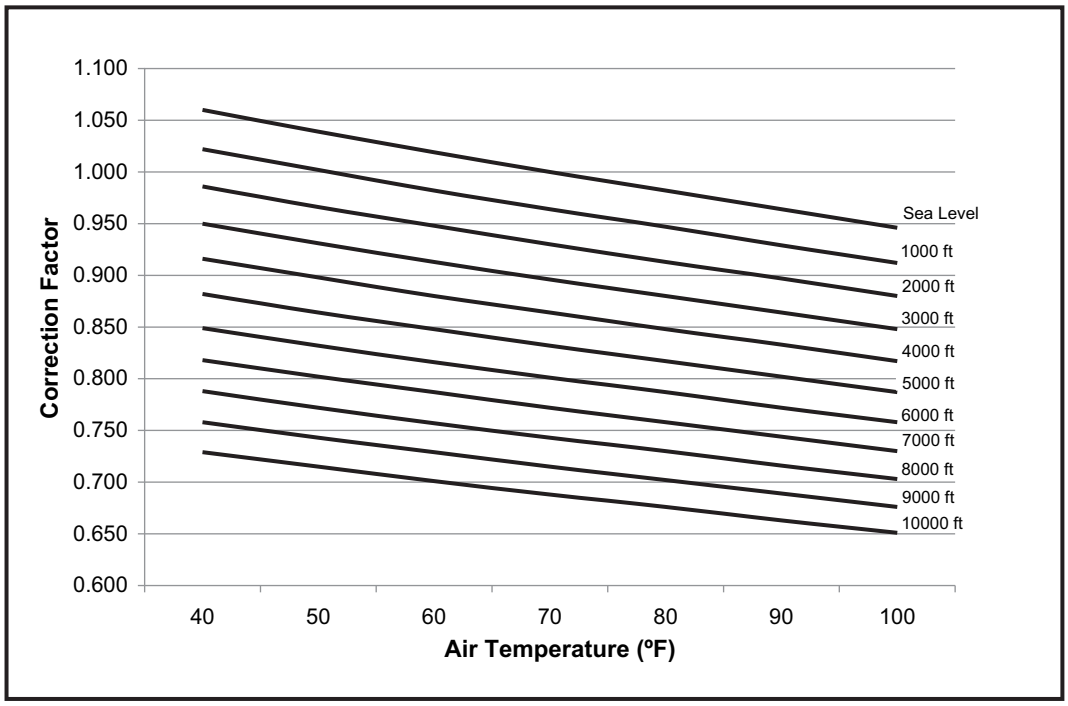

Figure 20: Altitude/Temperature Correction Factors

The examples below will assist in determining the airflow performance of the product at altitude.

Example 1: What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft. if the blower performance data is 6,000 CFM, 1.5 IWC and 4.0 BHP?

Solution: At an elevation of 5,000 ft. the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 14 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 14 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

Example 2: A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit blower tables to select the blower speed and the BHP requirement.

Solution: As in the example above, no temperature information is given so 70°F is assumed.

The 1.5" static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

Sea level static pressure = 1.5 / .832 = 1.80"

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

BHP at 5,000 ft. = 3.2 x .832 = 2.66

Drive Selection

1. Determine side or bottom supply duct application.
2. Determine desired airflow
3. Calculate or measure the amount of external static pressure.
4. Using the operating point determined from steps 1, 2 & 3, locate this point on the appropriate supply air blower performance table. (Linear interpolation may be necessary.)
5. Noting the RPM and BHP from step 4, locate the appropriate motor and/or drive on the RPM selection table.
6. Review the BHP compared to the motor options available. Select the appropriate motor and/or drive.
7. Review the RPM range for the motor options available. Select the appropriate drive if multiple drives are available for the chosen motor.
8. Determine turns open to obtain the desired operation point.

Example

1. 6800 CFM
2. 2.0 iwg
3. Using the supply air blower performance table below, the following data point was located: 1020 RPM & 5.92 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 5.92 BHP exceeds the maximum continuous BHP rating of the 5.0 HP motor. The 7.5 HP motor is required.
6. 1020 RPM is within the range of the 7.5 HP drives.
7. Using the 7.5 HP motor and drive, 3.5 turns open will achieve 1020 RPM.

Example Supply Air Blower Performance

Air Flow (CFM)	Available External Static Pressure - IWG																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive		Standard 5 HP & Drive										High Static 7.5 HP & Drive											
6400	719	2.55	756	3.03	792	3.49	828	3.92	864	4.32	899	4.67	933	4.98	966	5.24	998	5.45	1028	5.59	1056	5.67	1083	5.68
6800	742	3.02	778	3.51	814	3.97	850	4.40	886	4.79	921	5.15	955	5.46	988	5.72	1020	5.92	1050	6.07	1078	6.15	1105	6.16
7200	765	3.54	802	4.03	838	4.49	874	4.92	910	5.32	945	5.67	979	5.98	1012	6.24	1044	6.44	1074	6.59	1102	6.67	1129	6.68
7600	790	4.11	827	4.60	863	5.06	899	5.49	935	5.88	970	6.24	1004	6.55	1037	6.81	1069	7.01	1099	7.16	1127	7.24	1154	7.25
																					7.5 HP & Field Supplied Drive			

Table X: RPM Selection

Size (Tons)	Model	HP	Max BHP	Motor Sheave	Blower Sheave	6 Turns Open	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
X	Y	5	5.75	1VP60	BK110	730	765	800	835	870	905	N/A
		7.5	8.63	1VP60	BK090	905	950	990	1035	1075	1120	N/A

Table 15: Air Flow Performance - Side Duct Application

ZF180 (15 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																							
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive				Standard 5 HP & Drive						High Static 5 HP & Drive													
4400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	1184	TBD	TBD	TBD	TBD	TBD
4800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	1035	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	5.10	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
											5 HP & Field Supplied Drive													

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.838.

ZF210 (17.5 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																							
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive						Standard 5 HP & Drive										High Static 7.5 HP & Drive							
4400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
4800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5200	TBD	TBD	TBD	1.83	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5600	TBD	TBD	TBD	TBD	753	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6800	TBD	3.02	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
																			High Static 7.5 HP & Field Supplied Drive					

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.838.

ZF240 (20 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive				Standard 5 HP & Drive										High Static 7.5 HP & Drive									
5200	678	1.35	715	1.83	751	2.28	787	2.70	823	3.09	858	3.43	892	3.74	925	3.99	957	4.19	987	4.33	1015	4.41	1042	4.42
5600	697	1.74	733	2.22	770	2.67	806	3.09	842	3.48	876	3.82	911	4.13	944	4.38	975	4.58	1005	4.72	1034	4.80	1060	4.82
6000	717	2.17	754	2.65	790	3.10	826	3.52	862	3.90	897	4.25	931	4.55	964	4.81	996	5.01	1026	5.15	1054	5.23	1081	5.24
6400	740	2.64	776	3.11	812	3.57	848	3.99	884	4.37	919	4.72	953	5.02	986	5.28	1018	5.48	1048	5.62	1076	5.70	1103	5.71
6800	763	3.15	800	3.63	836	4.08	872	4.50	908	4.88	943	5.23	977	5.53	1010	5.79	1042	5.99	1072	6.13	1100	6.21	1127	6.22
7200	789	3.71	825	4.18	861	4.63	898	5.05	933	5.44	968	5.79	1002	6.09	1035	6.34	1067	6.55	1097	6.69	1126	6.77	1152	6.78
7600	815	4.31	852	4.79	888	5.24	924	5.66	960	6.04	995	6.39	1029	6.69	1062	6.95	1094	7.15	1124	7.29	1152	7.37	1179	7.38
8000	844	4.96	880	5.44	916	5.89	952	6.31	988	6.70	1023	7.04	1057	7.34	1090	7.60	1122	7.80	1152	7.94	1180	8.02	1207	8.03
8400	873	5.66	909	6.13	946	6.59	982	7.01	1018	7.39	1053	7.74	1087	8.04	1120	8.30	1151	8.50	1182	8.64	1210	8.72	1236	8.73
8800	904	6.40	940	6.88	977	7.33	1013	7.75	1048	8.14	1083	8.48	1117	8.79	-	-	-	-	-	-	-	-	-	-
9200	936	7.19	972	7.67	1009	8.12	1045	8.54	1080	8.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9600	969	8.03	1005	8.50	1042	8.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10000	1003	8.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													High Static 7.5 HP & Field Supplied Drive											

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.838.

ZF300 (25 Ton) Side Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]															
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Low Static 7.5 HP & Field Supplied Drive				Low Static 7.5 HP & Drive											
6600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
10200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
10600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
12200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
12600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	High Static 15 HP & Drive															

Standard 10 HP & Drive

Air Flow (CFM)	Available External Static Pressure - IWG[1]															
	2.0		2.2		2.4		2.6		2.8		3.0		3.2		3.4	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 10 HP & Drive										High Static 15 HP & Drive					
6600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9000	TBD	TBD	TBD	TBD	1189	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
10200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
10600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
12200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
12600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
							High Static 15 HP & Field Supplied Drive									

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.82.

Table 16: Air Flow Performance - Bottom Duct Application

ZF180 (15 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive		Standard 5 HP & Drive						High Static 5 HP & Drive															
4400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
4800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	1051	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
													5 HP & Field Supplied Drive											

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.838.

ZF210 (17.5 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																					
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive				Standard 5 HP & Drive												High Static 7.5 HP & Drive							
4400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	935	TBD	TBD	TBD	TBD	TBD	TBD	TBD
4800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
															High Static 7.5 HP & Field Supplied Drive									

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.838.

ZF240 (20 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]																							
	0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard 5 HP & Field Supplied Drive		Standard 5 HP & Drive										High Static 7.5 HP & Drive											
5200	711	1.47	747	1.92	782	2.34	818	2.73	853	3.09	887	3.42	921	3.70	953	3.94	985	4.13	1014	4.26	1042	4.34	1068	4.35
5600	732	1.89	768	2.33	803	2.76	839	3.15	874	3.51	908	3.84	942	4.12	974	4.36	1005	4.54	1035	4.68	1063	4.75	1089	4.76
6000	754	2.35	790	2.79	826	3.21	862	3.61	897	3.97	931	4.29	965	4.58	997	4.81	1028	5.00	1058	5.14	1086	5.21	1112	5.22
6400	779	2.85	814	3.29	850	3.71	886	4.11	921	4.47	955	4.79	989	5.08	1021	5.31	1052	5.50	1082	5.64	1110	5.71	1136	5.72
6800	804	3.39	840	3.84	876	4.26	912	4.65	947	5.01	981	5.34	1015	5.62	1047	5.86	1078	6.05	1108	6.18	1136	6.26	1162	6.27
7200	832	3.98	868	4.43	903	4.85	939	5.24	974	5.60	1008	5.93	1042	6.21	1074	6.45	1105	6.64	1135	6.77	1163	6.85	1189	6.86
7600	860	4.62	896	5.06	932	5.49	967	5.88	1002	6.24	1037	6.56	1070	6.85	1103	7.09	1134	7.27	1164	7.41	1192	7.48	1218	7.49
8000	890	5.30	926	5.74	962	6.17	997	6.56	1032	6.92	1067	7.24	1100	7.53	1133	7.77	1164	7.95	1194	8.09	1222	8.16	1248	8.17
8400	921	6.02	957	6.47	993	6.89	1028	7.28	1064	7.64	1098	7.97	1131	8.25	1164	8.49	1195	8.68	1225	8.81	-	-	-	-
8800	954	6.79	989	7.24	1025	7.66	1061	8.05	1096	8.41	1130	8.74	-	-	-	-	-	-	-	-	-	-	-	-
9200	987	7.60	1023	8.05	1059	8.47	1094	8.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9600	1021	8.45	1057	8.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10000	546	4.89	564	5.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													High Static 7.5 HP & Field Supplied Drive											

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.838.

ZF300 (25 Ton) Bottom Duct

Air Flow (CFM)	Available External Static Pressure - IWG[1]															
	0.4		0.6		0.8		1.0		1.2		1.4		1.6			
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP		
	Low Static 7.5 HP & Field Supplied Drive		Low Static 7.5 HP & Drive													
6600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
7000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
7400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
7800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
8200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
8600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
9000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
9400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
9800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
10200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
10600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
11000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
11400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
11800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
12200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
12600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
	High Static 15 HP & Drive															

Standard 10 HP & Drive

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	1.8		2.0		2.2		2.4		2.6		2.8		3.0		3.2		3.4			
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP		
	Standard 10 HP & Drive										High Static 15 HP & Drive									
6600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
7000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
7400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
7800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
8200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
8600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
9000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
9400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
9800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
10200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
10600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
11000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
11400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
11800	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
12200	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
12600	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD		
	High Static 15 HP & Field Supplied Drive																			

1. Blower performance includes gas heat exchangers and 2” filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.82.

Table 17: RPM Selection

Size (Tons)	Model	HP	Max BHP	Motor Sheave	Blower Sheave	6 Turns Open	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
180 (15)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
210 (17.5)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
240 (20)	ZF	5	5.75	1VP60	BK110	730	765	800	835	870	905	N/A
		7.5	8.63	1VP60	BK090	905	950	990	1035	1075	1120	N/A
300 (25)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 18: Indoor Blower Specifications

Size (Tons)	Model	Motor					Motor Sheave			Blower Sheave			Belt
		HP	RPM	Eff.	SF	Frame	Datum Dia. (in.)	Bore (in.)	Model	Datum Dia. (in.)	Bore (in.)	Model	
180 (15)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
210 (17.5)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
240 (20)	ZF	5	1725	0.89	1.15	184T	4.2 - 5.5	1 1/8	1VP60	10.4	1 3/16	BK110	BX78
		7.5	1725	0.91	1.15	213T	4.2 - 5.5	1 3/8	1VP60	8.4	1 3/16	BK090	BX75
300 (25)	ZF	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 19: Power Exhaust Specifications

Voltage	Motor			Motor			CFM @ 0.1 ESP
	HP	RPM[1]	QTY	LRA	FLA	MCA	
208/230-1-60	3/4	1075	1	7.7	5.0	6.25	5250
460-1-60	3/4	1075	1	4.1	2.2	2.75	5250
575-1-60	3/4	1050	1	2.84	1.5	1.875	5250

1. Motors are multi-tapped and factory wired for high speed.

Air Balance

⚠ CAUTION

On VAV units be certain that the VFD drive is set to maximum output, exhaust dampers are closed and individual space damper boxes are full open.

VFD units with bypass must not be in bypass mode ('LINE' position) unless all individual space dampers are full open.

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

To check the supply air CFM after the initial balancing has been completed:

1. Remove the two 5/16" dot plugs from the blower motor and the filter access panels shown in the Unit Dimensions and Rear View Clearances Figure 6.
2. Insert at least 8" of 1/4 inch tubing into each of these holes for sufficient penetration into the air flow on both sides of the indoor coil.

NOTE: The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Using an inclined manometer, determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil may vary greatly, measuring the pressure drop across a wet coil under field conditions would be inaccurate. To assure a dry coil, the compressors should be deactivated while the test is being run.

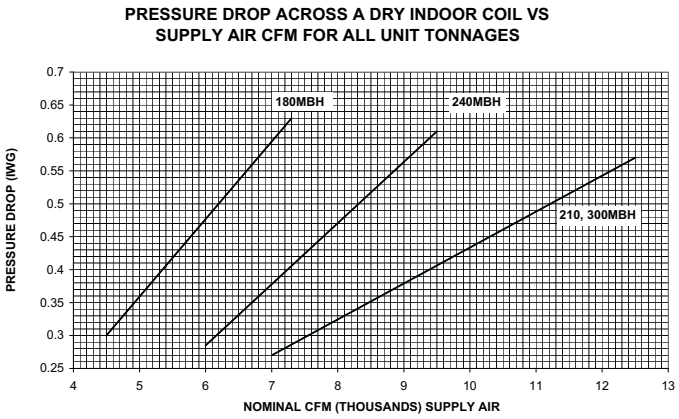

Figure 21: Pressure Drop Across A Dry Indoor Coil Vs. Supply Air CFM For All Unit Tonnages

4. Knowing the pressure drop across a dry coil, the actual CFM through the unit can be determined from the curve in Pressure Drop vs. Supply Air CFM Figure 21.

⚠WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

After readings have been obtained, remove the tubes and reinstall the two 5/16" dot plugs that were removed in Step 1.

NOTE: De-energize the compressors before taking any test measurements to assure a dry indoor coil.

Supply Air Drive Adjustment

The RPM of the supply air blower will depend on the required CFM, the unit accessories or options and the static resistances of both the supply and the return air duct systems. With this information, the RPM for the supply air blower and the motor pulley adjustment (turns open) can be determined from the Blower Performance Data Tables.

⚠ CAUTION

Belt drive blower systems MUST be adjusted to the specific static and CFM requirements for the application. The belt drive blowers are NOT set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are REQUIRED. Tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hours run time is recommended.

High speed drive accessories (containing a smaller blower pulley and a shorter belt) are available for applications requiring the supply air blower to produce higher CFM's and/or higher static pressures. Use Model 1LD0460 for 15 ton units, Model 1LD0417 for 17.5 and 20 ton units, and Model 1LD0435 for 25 ton units. Refer to the Blower Motor and Drive Data Table 18.

Note the following:

1. The supply air CFM must be within the limitations shown in the Blower Performance Tables 15 and 16.
2. Pulleys can be adjusted in half turn increments.
3. The tension on the belt should be adjusted as shown in the Bet Adjustment, Figure 19.
4. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hours run time recommended.

Additional Static Resistance

Size (Tons)	Model	CFM	Cooling Only[1]	Economizer[2 3]	Electric Heat kW[2]			
					18	36	54	72
180 (15)	ZF	4500	0.10	0.10	0.10	0.10	0.20	0.20
		6000	0.10	0.10	0.10	0.20	0.30	0.40
		7500	0.10	0.10	0.10	0.30	0.40	0.60
210 (17.5) 240 (20) 300 (25)	ZF	6000	0.10	0.10	0.10	0.10	0.20	0.20
		7500	0.10	0.10	0.10	0.20	0.30	0.40
		9000	0.15	0.15	0.10	0.30	0.40	0.60
		10500	0.15	0.15	0.20	0.40	0.60	0.80
		12000	0.20	0.20	0.30	0.50	0.70	0.90

1. Add these values to the available static resistance in the respective Blower Performance Tables.
2. Deduct these values from the available external static pressure shown in the respective Blower Performance Tables.
3. The pressure drop through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct is less than 0.25 IWG, the unit will deliver less CFM during full economizer operation.

Operation

Cooling Sequence Of Operation

For ZF units, the thermostat makes a circuit between “R” and “Y1” for the first stage of cooling.

The call is passed to the **Unit Control Board (UCB),** which then determines whether the requested operation is available and, if so, which components to energize.

For gas heating, the UCB monitors the "W1" call but does not handle the operation of the gas furnace. An ignition control board controls the gas heater operation. For electric heat units, the UCB passes the call to the electric heater. In both cases, when the "W1" call is sensed, the indoor air blower is energized following a specified heating delay.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

Continuous Blower

By setting the room thermostat fan switch to "ON," the supply air blower will operate continuously.

Intermittent Blower

With the room thermostat fan switch set to "AUTO" and the system switch set to either the "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

Optional VAV Startup and Control

⚠ CAUTION

If the unit is operated with the manual bypass switch in the LINE (BYPASS) position and there are VAV boxes present in the duct system, then boxes must be driven to the full-open position using a customer-supplied power source to prevent over-pressurizing and possible damage to the ductwork.

For units with VFD and VAV control, the unit must first be put into the Occupied Mode to start operation. The default setting for all VAV units is 'Unoccupied', therefore the installer must add a jumper wire between terminals R - OCC on the VAV add-on board to put the unit into 'Occupied' Mode. Additionally, the unit can be switched between Unoccupied/Occupied mode through network communications with Simplicity™ PC and other BAS control systems.

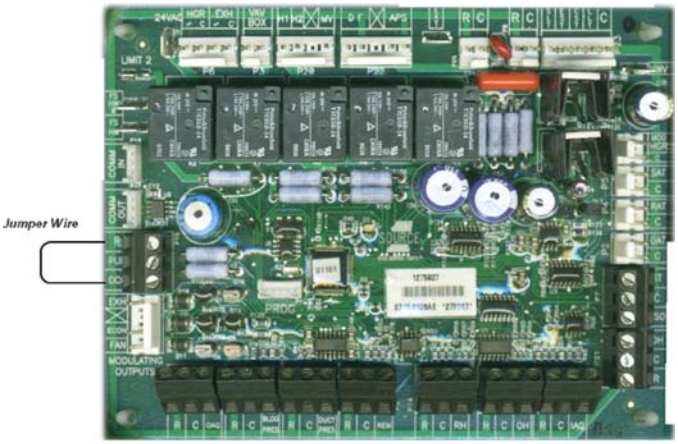

Figure 22: Occupied Jumper

Once placed into the Occupied Mode, the speed of the indoor blower motor is controlled by duct static pressure. The Duct Static set point (default = 1.5") is the pressure that the VFD drive will maintain when operating the unit in VAV mode. If the duct static pressure reaches or exceeds the high-limit set-point (default = 4.5"), then the supply fan motor will be shutdown.

The Supply Air Temperature (SAT) is controlled by staging compressors on and off to satisfy the "Operating Cooling Supply Air Temp Set point". There are 3 set points that determine the resulting "Operating Cooling Supply Air Temp Set point".

1. VAV Cooling Supply Air Temp Upper Set point (default 60° F)
2. VAV Cooling Supply Air Temp Lower Set point (default 55° F)
3. VAV Supply Air Temp Reset Set point (default 72° F)

When the Return Air Temp (RAT) is above the "VAV Supply Air Temp Reset Set point" the SAT will be maintained at +/- 5 degrees of the "VAV Cooling Supply Air Temp Lower Set point".

When the Return Air Temp (RAT) is below the "VAV Supply Air Temp Reset Set point" the SAT will be maintained at +/- 5 degrees of the "VAV Cooling Supply Air Temp Upper Set point".

When the Outdoor air condition is sufficient for free cooling, the economizer will modulate to control the SAT to +/- 1 degrees of the operational set point.

The following components are needed to access the control points in the Simplicity® controller. Installation and operation guide is located on UPGNET.

1. Computer running Windows software with a standard USB port.
2. Simplicity® PC Software (**http://www.yorkupg.com/software.asp**)

3. Freenet USB adapter driver, (**http://www.yorkupg.com/software.asp**)
4. Simplicity® Freenet USB Adapter (S1-03101967000)
5. Freenet service cable (S1-02538682000)

No Outdoor Air Options

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from “R” to “Y1” and “G” is completed. The UCB energizes the economizer (if installed and free cooling is available) or the first available compressor* and the condenser fans. For first stage cooling, compressor #1 is energized. If compressor #1 is unavailable, compressor #2 is energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

When the thermostat calls for the second stage of cooling, the low-voltage control circuit from “R” to “Y2” is completed. Compressor #2 is energized, provided it has not been locked out, and condenser fan motor #1, and condenser fan motor #2 remain energized. (If the ambient temperature is above 60ºF.)

If there is an initial call for more than one stage of cooling, the UCB will delay energizing compressors #2, #3 & #4 by 30 seconds each, depending on how many stages are called for, in order to avoid a power in-rush.

Once the thermostat has been satisfied, it will de-energize Y1, Y2, Y3 and Y4. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.

To be available, a compressor must not be locked-out due to a high or low-pressure switch or freezestat trip and the **Anti-Short Cycle Delay (ASCD)** must have elapsed.

These units utilize a lead-lag feature that results in an equal amount of run hours on all compressors, thereby extending the life of the compressors. This feature works as follows: If the thermostat requires for more than one stage of cooling, the currently off compressor with the least number of run hours will be the next to be energized. When the thermostat requires fewer stages of cooling, the currently running compressor with the most run hours will be the first to be de-energized.

Economizer With Single Enthalpy Sensor

When the room thermostat calls for “first-stage” cooling, the low voltage control circuit from “R” to “G” and “Y1” is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the “AUTO” position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (previously determined), “Y1” energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the set point, “Y1” energizes compressor #1.

When the thermostat calls for “second-stage” cooling, the low voltage control circuit from “R” to “Y2” is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the set point of the enthalpy controller (i.e. first stage has energized the economizer), “Y2” will energize compressor #1. If the outdoor air is above the set point, “Y2” will energize compressor #2. If Y2 brings on compressor #1 and this condition remains for more than 20 minutes, then compressor #2 will be energized until the thermostat is satisfied.

Once the thermostat has been satisfied, it will de-energize “Y1” and “Y2”. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continues fan operation, the economizer damper goes to the minimum position.

Economizer With Dual Enthalpy Sensors

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

Economizer With Power Exhaust

A unit equipped with an economizer (single or dual enthalpy) and a power exhaust operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan set point on the economizer control. When the power exhaust is operating, the second stage of mechanical cooling will not operate. As always, the "R" to "G" connection provides minimum position but does not provide power exhaust operation.

Economizer With Optional VAV Or Intelli-Comfort II™ Control

The position of the outside air and return air dampers are controlled through a 2-10 VDC signal from the VAV or Intelli-Comfort II™ control board. The economizer is enabled only in Occupied or Recovery mode. When the control is not powered or is in Unoccupied mode, the outside air dampers will be closed. When the supply fan is powered and there is no Y1 call, or if free-cooling is unavailable, the control opens the economizer dampers to the minimum position setting.

Free-cooling is available if the outdoor air temperature meets one of the three criteria discussed below, based upon the unit's configuration.

- **Dry Bulb:** The control refers to input from the Outside Air Temperature sensor and will allow free-cooling when the outdoor temperature is less than both the *First-Stage SAT Control* setpoint plus 5 °F, and the *Economizer OAT Enable* setpoint.

- **Single Enthalpy (optional):** A field-installed, Outdoor Air Humidity sensor is connected to the control. When the measured outdoor enthalpy is below the *Outside Air Enthalpy* setpoint, and the outdoor temperature is less than the *First-Stage SAT Control* setpoint plus 5 °F, free-cooling is available.
- **Dual Enthalpy (optional):** Both the field-installed Outdoor Air Humidity and the Return Air Humidity sensors are connected to the control. When the measured outdoor air enthalpy is less than the measured return air enthalpy, and the outdoor temperature is less than the *First-Stage SAT Control* setpoint plus 5 °F, free-cooling is available.

If free-cooling is available with a Y1 call, then the control modulates the economizer dampers to maintain the *First-Stage SAT Control* setpoint, plus or minus one degree. If free-cooling is unavailable, then 1st-stage mechanical cooling is initiated.

If at anytime the outdoor air temperature rises above the *First-Stage SAT Control* setpoint plus 5 °F, while free-cooling is available, then a Y1 call will also initiate 1st-stage mechanical cooling.

For a Y2 call, free-cooling is available based upon the criteria described above, except a *Second-Stage SAT Control* setpoint is used in the determination.

Once the call for cooling has been satisfied, it will de-energize any compressors and condenser fans, after the minimum compressor run times have been satisfied. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed.

Upon de-energizing the final compressor, the blower will continue to run with the economizer damper in its minimum position if in the Occupied mode; otherwise, the blower will stop following the elapse of the fan-off delay for cooling, and the economizer outdoor damper will close.

Economizer With Optional VAV Blower With Power Exhaust

The power exhaust motor is energized via the controller's EXH~ terminal and the ER relay, based on the position of the economizer damper parameter settings in the VAV control. Minimum run time is 10 seconds; minimum off time is 60 seconds. The outlet pressure of the power exhaust fan forces the barometric relief dampers open; gravity closes the dampers when the exhaust fan is off.

Economizer With Optional Intelli-Comfort II™ With Power Exhaust

The power exhaust motor is energized via the exhaust relay based on the position of the economizer actuator's auxiliary switch adjustment screw. The adjustment screw represents the outdoor damper position at which to activate power exhaust, and can be set between 25 to 85 degrees open. The outlet pressure of the power exhaust fan forces the barometric relief dampers open; gravity closes the dampers when the exhaust fan is off.

Motorized Outdoor Air Dampers

This system operation is the same as the units with no outdoor air options with one exception. When the “R” to “G” circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the “R” to “G” circuit is opened, the damper spring returns fully closed.

Cooling Operation Errors

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

High-Pressure Limit Switch

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (see Table 25). If the other compressor is inactive, the condenser fans will be de-energized.

Low-Pressure Limit Switch

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the LPS is still open after the ASCD, the compressor will not be energized for 30 seconds. The second and third times that the UCB sees an open LPS will count towards the three occurrences that will cause a UCB lock-out.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor and flash a code (Table 25). If the other compressor is inactive, the condenser fans will be de-energized.

Freezestat

During cooling operation, if a freezestat opens, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call

for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a freezestat open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (Table 25). If the other compressor is inactive, the condenser fans will be de-energized.

Low Ambient Cooling

To determine when to operate in low ambient mode, the UCB has a pair of terminals connected to a temperature-activated switch set at 45ºF. When the low ambient switch is closed and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The defrost cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, the UCB will not lockout the compressors due to a freezestat trip. However, a freezestat trip will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the freezestat has closed, the unit will resume operation.

Safety Controls

The unit control board monitors the following inputs for each cooling system:

1. A suction line freezestat to protect against low evaporator temperatures due to a low airflow or a low return air temperature, (opens at 26 ± 5 °F and resets at 38 ± 5°F).
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 625 ± 25 psig and resets 500 ± 25 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 50 ± 5 psig and resets at 71 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action. The other refrigerant system will continue in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace units.

Compressor Protection

In addition to the external pressure switches, the compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An **Anti-Short Cycle Delay (ASCD)** is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 25.

Reset

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature. This resets any pressure or freezestat flash codes.

Electric Heating Sequence Of Operations

The following sequence describes the operation of the electric heat section.

⚠ CAUTION

For units with VFD and electric heat, the speed of the indoor blower motor continues to be controlled by duct static pressure via the VAV control board.

If there are VAV boxes present in the duct system, the boxes must be driven to the full-open position using a customer-supplied power source to assure adequate airflow across the heating elements.

Single-stage heating: (applies only to 18 KW heater, all other heaters MUST use a two-stage thermostat)

a. Upon a call for heat by the thermostat, the heater contactor (6M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

Two-stage heating: (applies to all heaters except 18 KW)

a. Upon a call for first-stage heat by the thermostat, the heater contactor (6M) (6M & 7M on 72 KW, 240V) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

   If the second stage of heat is required, heater contactor (7M) will be energized. Note that on the 54 KW, 240V heater, heater contactors (7M & 8M) will be energized and on the 72 KW, 240V heater, heater contactors (8M & 9M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

NOTE: All 240 & 480V heaters are provided with manual reset backup protection limits. These will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

Electric Heat Operation Errors

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 25).

Safety Controls

The UCB monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

Temperature Limit Switch (TLs)

1. Temperature Limit Switch (TLS 1, 2).

   This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 20. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

2. Temperature Limit Switch (TLS 3, 4, 5 and 6).

   This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 20. It is a manual reset limit. These limit switches will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

Table 20: Limit Control Setting

Unit (Tons)	Voltage	Heater Kw	Temperature, Limit Switch 1, 2 Opens, °F	Temperature, Limit Switch 3, 4, 5, 6 Opens, °F
15	240	18	120	170
		36	120	170
		54	120	170
		72	120	170
17.5, 20 and 25	240	18	140	200
		36	140	200
		54	140	200
		72	140	200

Table 20: Limit Control Setting

Unit (Tons)	Voltage	Heater Kw	Temperature, Limit Switch 1, 2 Opens, °F	Temperature, Limit Switch 3, 4, 5, 6 Opens, °F
15, 17.5, 20 and 25	460	18	120	170
		36	120	170
		54	120	170
		72	120	170
15, 17.5, 20 and 25	600	18	120	-
		36	120	-
		54	120	-
		72	120	-

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 25.

Reset

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature.This resets any flash codes.

Electric Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON” cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 21 for the required electric heat anticipator setting.

Table 21: Electric Heat Anticipator Setpoint

Heater Kw	Voltage	Setting, Amps	
		Th1	Th2
18	208/230-3-60	0.29	-
36		0.29	0.29
54		0.29	0.58
72		0.29	0.58
18	460-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29
18	575-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29

Gas Heating Sequence Of Operations

The following sequence describes the operation of the gas heat section.

⚠ CAUTION

For units with VFD and gas heat, the speed of the indoor blower motor continues to be controlled by duct static pressure via the VAV control board.

If there are VAV boxes present in the duct system, the boxes must be driven to the full-open position using a customer-supplied power source to assure adequate airflow across the heat exchanger tubes.

When the thermostat calls for the first stage of heating, the low-voltage control circuit from “R” to “W1” and “G” is completed, thru the UCB. The heat relay “RW1” is energized. The “RW1-2” contacts close energizing the draft motor control. The draft motor control contacts close and start the draft motor. As the speed of the draft motor reaches approximately 2500 RPM, the centrifugal switch contact, located on the end of the draft motor shaft, closes to power the first stage ignition module “IC1”, thru the “RW1-1” contacts.

Ignition module “IC1” will immediately start the first stage igniter sparking and will open the redundant valve located inside the first stage main gas valve “GV1” to allow a flow of gas to only the first stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at the “IC1” by a signal sent back through the flame sensor is sparking terminated and the first stage main gas valve opened.

Gas flows into each of the main burners and is ignited from the carryover tube flame.

After completing the specified fan on delay for heating, the UCB will energize the blower motor.

If “IC1” fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then “IC1” will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

When the thermostat calls for the second stage of heating, the low-voltage control circuit from “R” to “W2” is completed, thru the UCB. Heat relay “RW2” is energized. The “RW2-1” contact is closed energizing the second stage ignition module “IC2”. “IC2” will immediately start the second stage igniter sparking and will open the redundant valve located inside the second stage main gas valve “GV2” to allow a flow of gas to the second stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at “IC2” by a signal sent back through the flame sensor is sparking terminated and the main gas valve opened.

Gas flows into each of the second stage main burners and is ignited from the carryover tube flame.

If “IC2” fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then “IC2” will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

NOTE: That the second stage furnace can operate even if first stage has locked out.

When the thermostat satisfies de-energizing the “RW2”and “RW1”, thus opening all gas valves. The blower motor will continue to run after the furnace is shut down until the specified fan off delay for heating has been satisfied. The UCB will de-energize the blower motor.

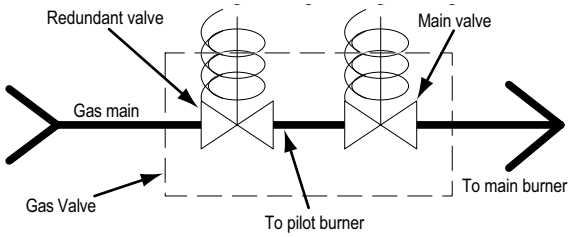

Figure 23: Gas Valve Piping

When the thermostat calls for the first stage of heating, the low-voltage control circuit from “R” to “W1” is completed. A call for heat passes through the UCB to the ignition control board (ICB). The UCB monitors the “W1” call and acts upon any call for heat. Once voltage has been sensed at “W1”, the UCB will initiate the fan on delay for heating, energizing the indoor blower after the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately de-energized. The blower is de-energized after the fan off delay for heating has elapsed. The draft motor performs a 25-second post purge.

Gas Heating Operation Errors

Temperature Limit

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 25-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

This limit is monitored regardless of unit operation status, i.e. this limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and flash code is initiated (See Table 25).

Gas Valve

The UCB continuously monitors the GV. Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock-on the indoor blower and a flash code is initiated (Table 25). When voltage is no longer sensed at the GV, the UCB will de-energize the indoor blower following the elapse of the fan off delay for heating.

If voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and GV voltage or “W1” is lost, the indoor blower is forced on for the length of the fan off delay for heating.

Safety Controls

The UCB monitors the temperature limit switch of gas heat units.

The control circuit includes the following safety controls:

Limit Switch (LS)

This control is located inside the gas heat compartment and is set to open at the temperature indicated in the Gas Heat Limit Control Settings Table 22. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

Centrifugal Switch (CS)

If the draft motor should fail, the centrifugal switch attached to the shaft of the motor prevents the ignition controls and gas valves from being energized.

Redundant Gas Valve

There are two separate gas valves in the furnace. Each valve contains a main and a redundant valve. The redundant valves are located upstream of the main gas valves. Should either or both of the main gas valves fail in the open position the redundant valves serve as back-ups and shut off the flow of gas.

Flame Sensor Rod / 100% Ignition Control Lock-Out.

The flame rods and controls are located per Proper Flame Adjustment Figure 25. If an ignition control fails to detect a signal from the flame sensor indicating the pilot flame is properly ignited, then the main gas valve will not open. It will continue to try and ignite the pilot for a maximum of 85 seconds, then if the pilot flame is not detected, the ignition control will lock out furnace operation until 24V power is removed from the module either at the unit or by resetting the room thermostat.

Rollout Switch

This switch is located above the main burners in the control compartment, which in the event of a sustained main burner rollout shuts off and locks out both ignition controls closing both gas valves. The ignition controls lock out furnace operation until 24V power is removed from the controls either at the unit or by resetting the room thermostat.

Auxiliary Limit Switch (AUX)

This control is located inside the heat exchanger compartment and is set to open at 190°F. It is a manual reset switch. If AUX trips, then the primary limit has not functioned correctly. Replace the primary limit.

Table 22: Gas Heat Limit Control Setting

Units (Tons)	Capacity, MBH		Limit Control Opens, ºF
	Input	Output	
15, 17.5, 20 & 25	300	240	195
15, 17.5, 20 & 25	400	320	195

The ICB monitors the Pressure and Rollout switches of gas heat units.

The control circuit includes the following safety controls:

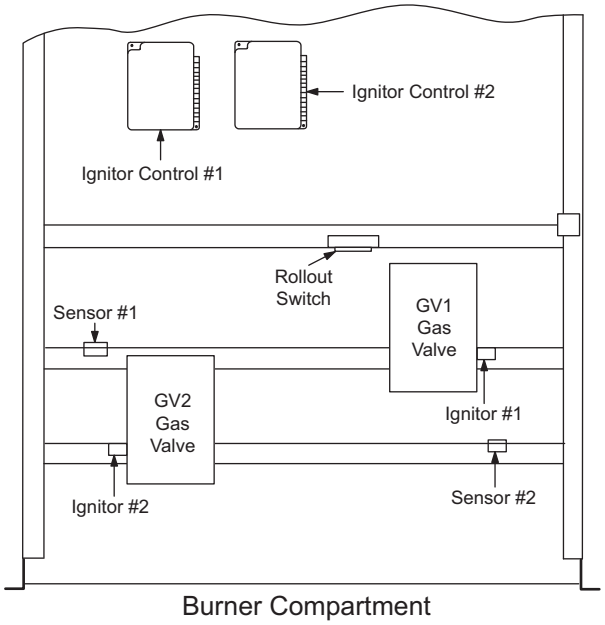

Figure 24: Gas Valve and Controls

Flash Codes

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 25.

Resets

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

Gas Heat Anticipator Setpoints

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 23 for the required gas heat anticipator setting.

Table 23: Gas Heat Anticipator Setpoints

Gas Valve	Anticipator Setpoint	
	1st Stage	2nd Stage
Honeywell VR8440 White-Rodgers 36C68	0.30 amp	0.11 amp

Start-Up (Cooling)

Prestart Check List

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
   - If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.

   Check blower drive belt tension.
6. Check the unit supply air (CFM).
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

Operating Instructions

1. Turn unit electrical power on.
2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

Post Start Check List

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.
3. Measure the system amperage draw across all legs of 3 phase power wires.
4. Measure the condenser fan amperage draw.

Start-Up (Gas Heat)

Pre-Start Check List

Complete the following checks before starting the unit.

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent and combustion hoods have been properly installed.

Operating Instructions

⚠ CAUTION

This furnace is equipped with an intermittent pilot and automatic re-ignition system. DO NOT attempt to manually light the pilot.

Lighting The Main Burners

1. Turn “OFF” electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve knob or switch to “ON” position (See Figure 27).
4. Turn “ON” electric power to unit.
5. Set room thermostat to desired temperature (If thermostat “set” temperature is above room temperature, pilot burner ignition will occur and, after an interval to prove pilot flame, main burners will ignite).

Post Start Checklist

After the entire control circuit has been energized and the heating section is operating, make the following checks:

1. Check for gas leaks in the unit piping as well as the supply piping.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

2. Check for correct manifold gas pressures. (See CHECKING GAS INPUT.)
3. Check the supply gas pressure. It must be within the limits shown on the rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas pressure exceed 13 in. or the operating pressure drop below 5.0 in for natural gas units. If gas pressure is outside these limits, contact the local gas utility or propane supplier for corrective action.

Shut Down

1. Set the thermostat to the lowest temperature setting.
2. Turn “OFF” all electric power to unit.
3. Open gas heat access panel.
4. Turn gas valve clockwise to “OFF” position (See Figure 27).

Checking Gas Heat Input

1. Turn off all other gas appliances connected to the gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter usually has a 1/2 or a 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour from the Gas Rate - Cubic Feet Per Hour Table 24.

If the actual input is not within 5% of the furnace rating (with allowance being made for the permissible range of the regulator setting), replace the orifice spuds with spuds of the proper size.

NOTE: To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.).

Table 24: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
4	450	900
6	300	600
8	228	450
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180

Table 24: Gas Rate Cubic Feet Per Hour

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
22	82	164
24	75	150
26	69	138
28	64	129

EXAMPLE

By actual measurement, it takes 13 seconds for the hand on the 1-cubic foot dial to make a revolution with just a 300,000 Btuh furnace running. Read across to the column in the table above, headed “1 Cubic Foot”, where you will see that 278 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 278 x 1050 (the Btu rating of the gas obtained from the local gas company). The result is 292,425 Btuh, which is close to the 300,000 Btuh rating of the furnace.

Manifold Gas Pressure Adjustment

Small adjustments to the high-fire gas flow may be made by turning the pressure regulator adjusting screw on the automatic gas valve.

Adjust as follows:

1. Remove the cap on the regulator. It's located next to the push-on electrical terminals.
2. To decrease the gas pressure, turn the adjusting screw counterclockwise.
3. To increase the gas pressure, turn the adjusting screw clockwise.

NOTE: The correct manifold pressure for these furnaces is 3.65 IWG ± 0.3.

Adjustment Of Temperature Rise

The temperature rise (the difference of temperature between the return air and the heated air from the furnace) must lie within the range shown on the CSA rating plate and the data in Table 11.

After the temperature rise has been determined, the CFM can be calculated as follows:

$$CFM = \text{Btu Input} \cdot \frac{0.8}{(1.08 \cdot \Delta°F)}$$

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about 6 feet from the furnace) where they will not be affected by radiant heat. Increase the blower CFM to decrease the temperature rise; decrease the blower CFM to increase the rise (See SUPPLY AIR DRIVE ADJUSTMENT).

NOTE: Each gas heat exchanger size has a minimum allowable CFM. Below this CFM, the limit will open.

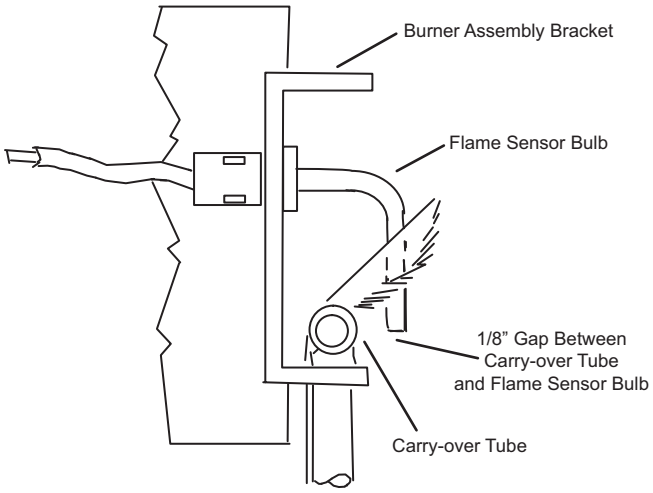

Figure 25: Proper Pilot Flame Adjustment

Pilot Checkout

The pilot flame should envelope the end of the flame sensor. To adjust pilot flame, (1) remove pilot adjustment cover screw, (2) increase or decrease the clearance for air to the desired level, (3) be sure to replace cover screw after adjustment to prevent possible gas leakage.

Put the system into operation and observe through complete cycle to be sure all controls function properly.

Burner Instruction

To check or change burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL ELECTRIC POWER TO THE UNIT.

1. Remove the screws holding either end of the manifold to the burner supports.
2. Open the union fitting in the gas supply line just upstream of the unit gas valve and downstream from the main manual shut-off valve.
3. Remove the gas piping closure panel.
4. Disconnect wiring to the gas valves and spark ignitors. Remove the manifold-burner gas valve assembly by lifting up and pulling back.

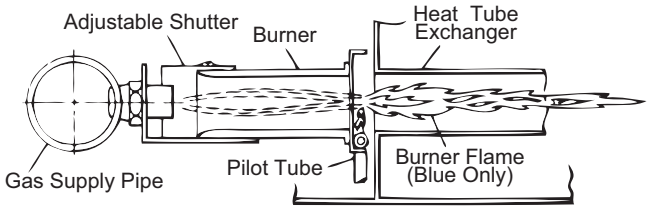

Figure 26: Typical Flame

Burners are now accessible for service.

Reverse the above procedure to replace the assemblies. Make sure that burners are level and seat at the rear of the heat exchanger.

Burner Air Shutter Adjustment

Adjust burner shutters so no yellow flame is observed in the heat exchanger tubes.

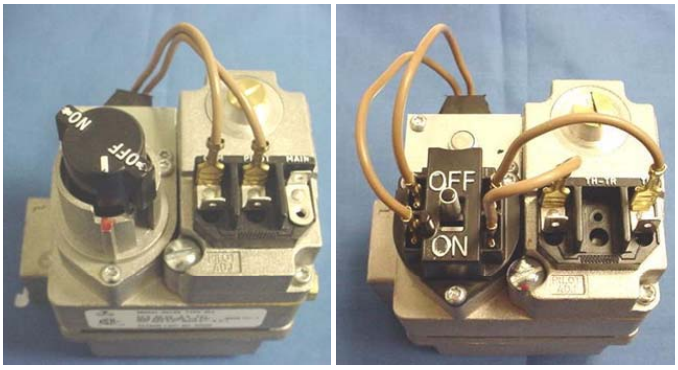

Figure 27: Typical Gas Valve

Charging The Unit

TBD

Figure 28: ZF180 (15 Ton) Charging Chart

TBD

Figure 29: ZF210 (17.5 Ton) Charging Chart

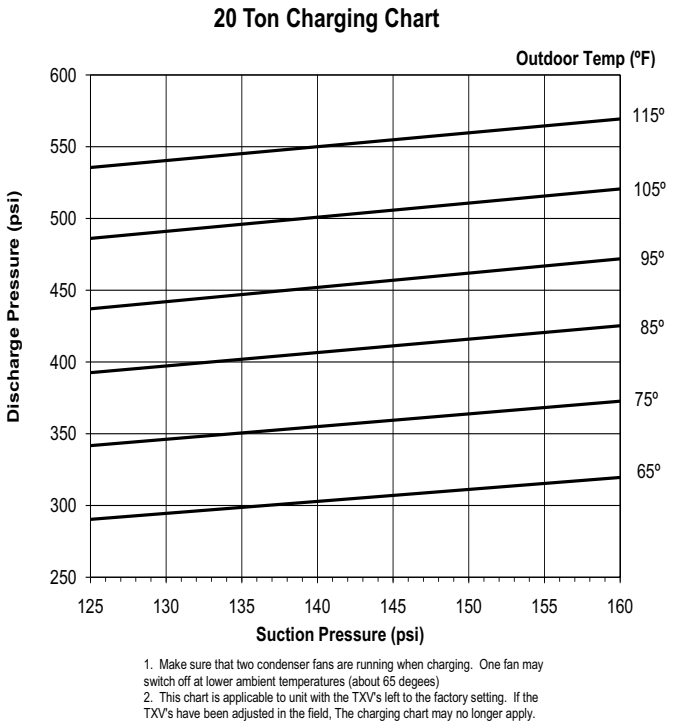

Figure 30: ZF240 (20 Ton) Charging Chart

TBD

Figure 31: ZF300 (25 Ton) Charging Chart

Troubleshooting

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

For troubleshooting of optional VFD, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

Cooling Troubleshooting Guide

On calls for cooling, if the compressors are operating but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in the “AUTO” position):

1. Turn the thermostat fan switch to the ON position. If the supply air blower motor does not energize, go to Step 2.
2. If the supply air blower motor does not energize when the fan switch is set to ON, check that line voltage is being supplied to the contacts of the M3, contactor, and that the contactor is pulled in. For units with VFD, check that line voltage is being supplied to the M3-Auxiliary contacts. Check for loose wiring between the contactor and the supply air blower motor.
3. If M3 is pulled in and voltage is supplied to M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on internal protection. Cancel any thermostat calls and set the fan switch to AUTO. Wait for the internal overload to reset. Test again when cool.
4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts are present at M3 but M3 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.

   For units with VFD, if there is line voltage supplied at M3, M3 is pulled in, and the blower motor does not operate, check all power & control wiring connections to and from the drive and for any fault/warning messages displayed on the drive's digital display (refer to the drive user manual for full descriptions, if necessary). Clear any fault by pressing 'RESET' on the drive's keypad and take any corrective action as needed. If the motor still does not operate, replace the motor.
6. If 24 volts is not present at M3, check that 24 volts is present at the UCB supply air blower motor terminal, “FAN”. If 24 volts is present at the FAN, check for loose wiring between the UCB and M3.
7. If 24 volts is not present at the “FAN” terminal, check for 24 volts from the room thermostat. If 24 volts are not present from the room thermostat, check for the following:
   a. Proper operation of the room thermostat (contact between R and G with the fan switch in the ON position and in the AUTO position during operation calls).
   b. Proper wiring between the room thermostat and the UCB, and
   c. Loose wiring from the room thermostat to the UCB
8. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
9. If the thermostat and UCB are properly wired, replace the UCB.

On calls for cooling, the supply air blower motor is operating but compressor #1 is not (the room thermostat fan switch is in the “AUTO” position):

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling and the compressors will not immediately operate. If both stages of cooling are requested simultaneously and the economizer provides free cooling, following a short delay compressor #1 will be energized unless it is locked out. If compressor #1 is locked out, compressor #2 is energized. Compressor #2 is always energized in place of compressor #1 when compressor #1 is requested but locked out.
2. If no economizer is installed or the economizer is not opening to provide free cooling and compressor #1 does not energize on a call for cooling, check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts are present and M1 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.

7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts is not present from the room thermostat, check for the following:
   a. 24 volts at the thermostat Y1 terminal
   b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2, and
   c. Loose wiring from the room thermostat to the UCB
8. If 24 volts is present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.
9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing an alarm code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, cancel any call for cooling. This will reset any compressor lock outs. If the LPS is still open after the ASCD, the compressor will not be energized for 30 seconds. The second and third times that the UCB sees an open LPS will count towards the three occurrences that will cause a UCB lock-out.

NOTE: While the above step will reset any lockouts, compressor #1 may be held off for the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 “OUT” terminal of the UCB. If 24 volts is present, trace the wiring from Y1 “OUT” for incorrect wiring. If 24 volts is not present at the Y1 “OUT” terminal, the UCB must be replaced.
12. *For units without economizers*: If 24 volts is present at the Y1 OUT terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 “ECON” terminal.
13. *For units with economizers*: If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 “ECON” terminal. If nothing is found, the economizer control may have faulted and is failing to return the 24-volt “call” to the Y1 “ECON” terminal even though the economizer is not providing free cooling. To test, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB’s Mate-N-Lock plug. If compressor #1 energizes, there is a fault in the economizer wiring or the economizer control.
14. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
15. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.
16. If none of the above correct the error, replace the UCB.

On calls for the second stage of cooling, the supply air blower motor and compressor #1 are operating but compressor #2 is not (the room thermostat fan switch is in the “AUTO” position):

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling. If the second stage of cooling is requested, following a short delay, compressor #1 will be energized unless it is locked out. Typically, compressor #2 is energized only during free cooling if the call for the second stage of cooling persists for 20 minutes.
2. Compressor #2 will not energize simultaneously with compressor #1 if a call for both stages of cooling is received. The UCB delays compressor #2 by 30 seconds to prevent a power surge. If after the delay compressor #2 does not energize on a second stage call for cooling, check for line voltage at the compressor contactor, M2, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M2 is pulled in and voltage is supplied at M2, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M2 is not pulled in, check for 24 volts at the M2 coil. If 24 volts is present and M2 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M2, M2 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M2, check for 24 volts at the UCB terminal, C2. If 24 volts are present, check for loose wiring between C2 and the compressor contactor.
7. If 24 volts is not present at the C2 terminal, check for 24 volts from the room thermostat at the UCB Y2 terminal. If

24 volts is not present from the room thermostat, check for the following:

a. 24 volts at the thermostat Y2 terminal

b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2, and

c. Loose wiring from the room thermostat to the UCB

8. If 24 volts is present at the UCB Y2 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS2, LPS2, and FS2 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS2 has opened, there will be 24 volts of potential between the LPS2 terminals.
9. If 24 volts is present at the UCB Y2 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling at the thermostat or by disconnecting the thermostat wiring at the Y2 on the UCB terminal. This will reset any compressor lock outs, except LPS lockouts these can only be reset by cycling power to UCB.

NOTE: While the above step will reset any lock outs, compressor #1 will be held off for the ASCD, and compressor #2 may be held off for a portion of the ASCD. See the next step.

10. If 24 volts is present at the UCB Y2 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
12. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C2 terminal wire and jumper it to the Y2 terminal. DO NOT jump the Y2 to C2 terminals. If the compressor engages, the UCB has faulted.
13. If none of the above correct the error, replace the UCB.

On a call for cooling, the supply air blower motor and compressor #2 are operating but compressor #1 is not (the room thermostat fan switch is in the “AUTO” position):

1. Compressor #2 is energized in place of compressor #1 when compressor #1 is unavailable for cooling calls. Check the UCB for alarms indicating that compressor #1 is locked out. Press and release the ALARMS button if the LED is not flashing an alarm.
2. Check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts is present and M1 is not pulled in, replace the contactor.
5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.
7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts are not present at the UCB Y1 terminal, the UCB may have faulted. Check for 24 volts at the Y1 ECON terminal. If 24 volts is not present at Y1 “ECON”, the UCB has faulted. The UCB should de-energize all compressors on a loss of call for the first stage of cooling, i.e. a loss if 24 volts at the Y1 terminal.
8. If 24 volts are present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.
9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling. This will reset any compressor lock outs, except LPS lockouts. These can only be reset by cycling power to the UCB.

NOTE: While the above step will reset any lock outs, compressor #2 will be held off for the ASCD, and compressor #1 may be held off for a portion of the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 “OUT” terminal of the UCB. If 24 volts is present, trace the wiring

from Y1 “OUT” for incorrect wiring. If 24 volts is not present at the Y1 “OUT” terminal, the UCB must be replaced.

12. *For units without economizers:* If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 “ECON” terminal.

    For units with economizers: If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 “ECON” terminal. The economizer control may have faulted and is not returning the 24 volts to the Y1 “ECON” terminal even though the economizer is not providing free cooling. To test the economizer control, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB’s Mate-N-Lock plug.

13. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. They can be checked by local distributors.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

14. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.

15. If none of the above correct the error, replace the UCB.

Gas Heat Troubleshooting Guide

On calls for heating, the draft motor operates and the furnace lights but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in “AUTO” position).

⚠WARNING

The furnace may shut down on a high temperature condition during the procedure. If this occurs, the UCB energize the supply air blower motor until the high temperature limit has reset. Caution should be used at all times as the supply air blower may energize regardless of the room thermostat fan switch position.

For troubleshooting of optional VFD, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

1. Place the thermostat fan switch in the “ON” position. If the supply air blower motor energizes, go to Step 9.
2. If the supply air blower motor does not energize when the fan switch is set to “ON,” check that line voltage is being supplied to the contacts of the M3 contactor, and that the contactor is pulled in. For units with VFD, check that line voltage is being supplied to the M3-Auxiliary contacts. Check for loose wiring between the contactor and the supply air blower motor.
3. If M3 is pulled in and voltage is supplied at M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on inherent protection. Cancel any thermostat calls and set the fan switch to “AUTO”, wait for the internal overload to reset. Test again when cool.
4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts is present at M3 but M3 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.

    For units with VFD, if there is line voltage supplied at M3, M3 is pulled in, and the blower motor does not operate, check all power & control wiring connections to and from the drive and for any fault/warning messages displayed on the drive's digital display (refer to the drive user manual for full descriptions, if necessary). Clear any fault by pressing 'RESET' on the drive's keypad and take any corrective action as needed. If the motor still does not operate, replace the motor.

6. If 24 volts is not present at M3, check that 24 volts is present at the supply air blower motor terminal on the UCB. If 24 volts is present at the UCB terminal, check for loose wiring between the UCB and M3.
   a. If 24 volts is not present at the UCB supply air blower motor terminal, check for 24 volts from the room thermostat. If 24 volts is not present from the room thermostat, check for the following:
      - Proper operation of the room thermostat (contact between R and G with the fan switch in the “ON” position and in the “AUTO” position during operation calls.)
      - Proper wiring between the room thermostat and the UCB, and
      - Loose wiring from the room thermostat to the UCB
7. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
8. If the thermostat and UCB are properly wired, replace the UCB.
9. If the blower motor runs with the fan switch in the “ON” position but does not run shortly after the furnace has ignited when the fan switch is in the “AUTO” position, check the room thermostat for contact between R and G during “W1” calls.

On calls for heating, the supply air blower operates but the draft motor does not (the room thermostat fan switch is in the “AUTO” position).

1. The draft motor has inherent protection. If the motor shell is hot to the touch, wait for the internal overload to reset.
2. If the motor shell is cold with the room thermostat calling for heat, check for line voltage at the motor's Mate-N-Lok connector attached to the evaporator partition. If line voltage is present, replace the draft motor.
3. If line voltage is not present, check for line voltage at the heat relay (RW1) contacts in the main control box and check to see if the (RW1) is pulled in.
4. If the (RW1) relay is pulled in, check for a loose line voltage connection.
5. If the (RW1) relay is not pulled in, check for 24 volts at the (RW1) coil. If 24 volts is present, replace the (RW1) relay. If 24 volts is not present, check for a loose 24 volt connection back to the relay board and check the connections from the room thermostat to the relay board. If all connections are correct, replace the relay board.

The draft motor runs but the furnace does not light and the sparker does not spark.

1. The ignition control (IC1, IC2) may be locked out due to either a flame roll out or 100% shut off. These safety features are described above. If lock-out has occurred, 24V must be removed from the ignition controls. This is done at the unit or by resetting the room thermostat. After resetting 24V, check for proper furnace operation. If lock-out continues to occur, locate the source of the problem and correct.
2. Check all 24 volt connections from the relay board to and in the gas heat section. Check low voltage connections to the (ETD) located in the control box.
3. If the furnace is hot, it may be out on an over-temperature condition, wait for limit reset.
4. If the furnace is cold, check for 24 volts at wire 241 attached to the electrical time delay (ETD) located in the main control box. If 24 volts is not found, replace the ETD.
5. 24 volts is found at wire 241, remove the wires attached to the (TDR) and with a VOM, check for continuity across contacts 1 and 2. If none is found, the (TDR) is open and must be replaced. If there is continuity, re-attach the wires.With the draft motor running, check for 24 volts at terminal 4 of (RW1-2) and (RW2-1). If 24 volts is not present, the centrifugal switch (CS) has not closed or has gone bad. Check the line voltage to the unit - if it is correct, replace the draft motor. If line voltage is low, call the power company.
6. Check for 24V at terminal 2 of (RW1-2 and RW2-1). If 24V is not present, check for 24V at (RW1 and RW2) relay coils. If these relays are pulled in, then check for a loose connection at terminal 2 and terminal 4 of each relay. If no problem is found, then replace (RW1 and/or RW2) as required.
7. If 24 volts is present at the ignitor controls, check all control wiring at the ignitor controls and the high tension wire to the ignitors. Check that the ground wires from the ignitor controls, the gas valves and pilot burners are all intact and making good electrical connection. Check to make sure that the ceramic insulator on the pilot ignitors or sensors is not broken or cracked, if all are intact, replace the ignition control IC1 or IC2.

The draft motor runs and the ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is not detected at the draft motor outlet.

1. Check to make sure gas is being supplied to the unit. Make sure that the gas pressure to the unit is within the proper limits as described in the “POST START CHECK LIST” page 53 and that the pilot adjust screw is allowing some flow of gas as described in “PILOT CHECKOUT” page 55.
2. Check all wiring between the ignitor control and the gas valve. Check to make sure the ground connections are intact.
3. If the wiring is intact, check for 24 volts across terminals “PV” and “COMMON” on the ignitor control. If 24 volts is not present, replace the ignitor control.
4. If 24 volts is present, remove the pilot burner and remove the pilot orifice from the pilot burner. The orifice is removed in the direction opposite the flow of gas. Inspect the orifice for obstruction. If it is clear, replace the main gas valve.

The ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is detected at the draft motor outlet.

1. Adjust the pilot adjust screw on the gas valve as described in “PILOT CHECKOUT” page 55.
2. Check the supply pressure as described in “POST START CHECK LIST” page 53. Make adjustments as necessary.

3. Check the pilot orifice for obstruction as described in paragraph above. Clean as needed but the problem should not be the gas valve.

The pilot burner ignites but the ignitor continues to spark and the main burners do not ignite.

1. Make the same checks and adjustment as described in “PILOT CHECKOUT” page 55.
2. Check the supply pressure as described in “POST START CHECK LIST” page 53. Make adjustments as necessary.
3. Make sure that the pilot burner is not bent or damaged.
4. Make sure that the ground connections at the pilot burner, gas valve and ignitor control are intact. Check the high tension wire for good electrical connection. If all are intact, replace the ignitor module.

The pilot burner lights and the spark stops but the main burners do not light.

1. Check electrical connections between the ignitor control and the gas valve. If intact, check for 24 volts across terminals “MV” and “COMMON” terminals. If no voltage detected, replace ignitor control. If voltage is present, replace gas valve.

Furnace lights with roll-out or one burner has delayed ignition.

1. Make sure that the pilot burner is aligned properly with the carryover as described in “PILOT CHECKOUT” page 55.
2. Make sure that the carryovers on adjoining burners are screwed fast and are level with respect to one another.

Main burners light but exhibit erratic flame characteristics.

1. Adjust air shutters as described in “BURNER AIR SHUTTER ADJUSTMENT” page 55.
2. Check the main burner orifices for obstruction and alignment. Removal procedure is described in BURNER INSTRUCTIONS page 55. Clean or replace burner orifices and burners as needed.

Unit Control Board Flash Codes

Various flash codes are utilized by the unit control board (UCB) to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control board flashes a 1 second on, 1 second off “heartbeat” during normal operation. This is to verify that the UCB is functioning correctly. Do not confuse this with an error flash code. To prevent confusion, a 1-flash, flash code is not used.

Alarm condition codes are flashed on the UCB lower left Red LED, See Figure 32. While the alarm code is being flashed, it will also be shown by the other LEDs: lit continuously while the alarm is being flashed. The total of the continuously lit LEDs equates to the number of flashes, and is shown in the table. Pressing and releasing the LAST ERROR button on the UCB can check the alarm history. The UCB will cycle through the last five (5) alarms, most recent to oldest, separating each alarm flash code by approximately 2 seconds. Flash code 21 is a non-alarm condition but due to the space constraints of the UCB, will be indicated by the Red LED. In all other cases, a flashing Green LED will be used to indicate non-alarm conditions.

In some cases, it may be necessary to “zero” the ASCD for the compressors in order to perform troubleshooting. To reset all ASCDs for one cycle, press and release the UCB TEST/ RESET button once.

Flash codes that do and do not represent alarms are listed in Table 25.

Table 25: Unit Control Board Flash Codes

FLASH CODE	DESCRIPTION	GREEN LED 16	RED LED 8	RED LED 4	RED LED 2	RED LED 1
On Steady	This is a Control Failure	-	-	-	-	-
1 Flash	Not Applicable	-	-	-	-	-
2 Flashes	Control waiting ASCD[1]	Flashing	Off	Off	On	Off
3 Flashes	HPS1 Compressor Lockout	Off	Off	Off	On	On
4 Flashes	HPS2 Compressor Lockout	Off	Off	On	Off	Off
5 Flashes	LPS1 Compressor Lockout	Off	Off	On	Off	On
6 Flashes	LPS2 Compressor Lockout	Off	Off	On	On	Off
7 Flashes	FS1 Compressor Lockout	Off	Off	On	On	On
8 Flashes	FS2 Compressor Lockout	Off	On	Off	Off	Off
9 Flashes	Ignition Control Locked Out / Ignition Control Failure	Off	On	Off	Off	On
10 Flashes	Compressors Locked Out on Low Outdoor Air Temperature[1]	Flashing	On	Off	On	Off
11 Flashes	Compressors locked out because the Economizer is using free Cooling[1]	Flashing	On	Off	On	On
12 Flashes	Unit Locked Out due to Fan Overload Switch Failure	Off	On	On	Off	Off
13 Flashes	Compressor Held Off due to Low Voltage[1]	Flashing	On	On	Off	On
14 Flashes	EEPROM Storage Failure	Off	On	On	On	Off
OFF	No Power or Control Failure	Off	Off	Off	Off	Off

1. Non-alarm condition.

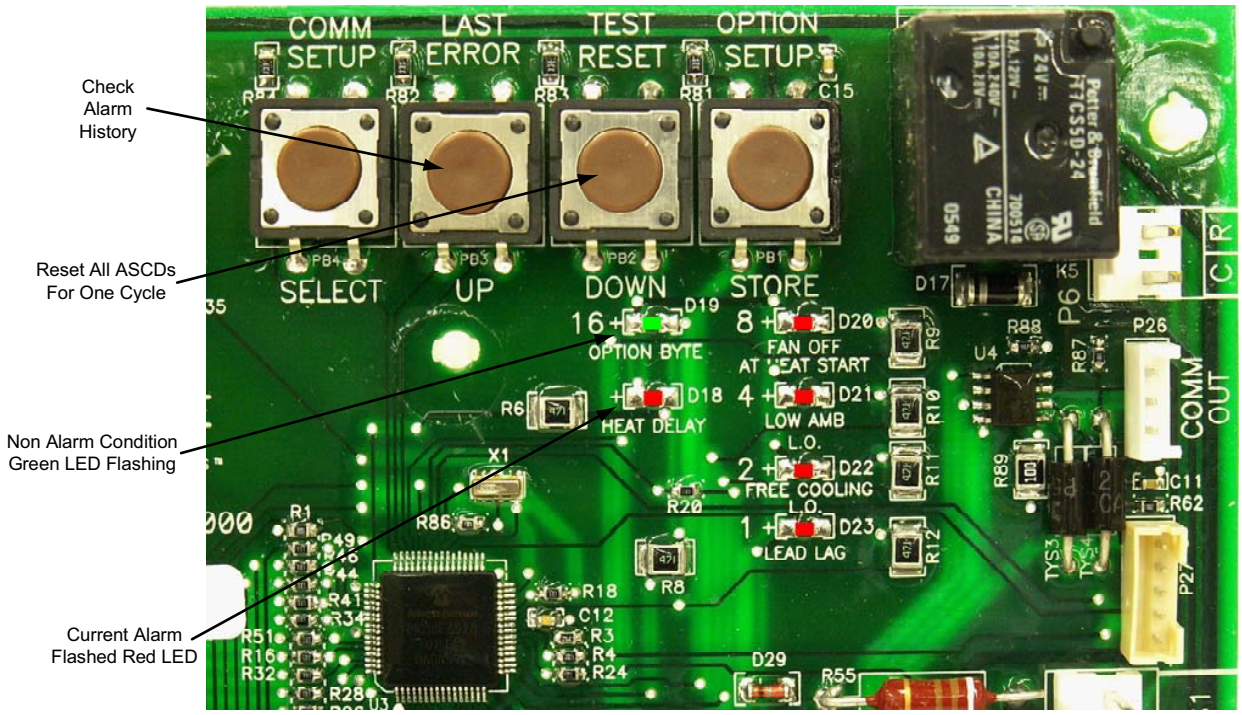

Figure 32: Unit Control Board

Unit Control Board Option Setup

Option Byte Setup

- Enter the Option Setup mode by pushing the OPTION SETUP / STORE button, and holding it for at least 2 seconds.
- The green status LED (Option Byte) will be turned on and the red status LED (Heat Delay) is turned off.
- The 8, 4, 2 and 1 LEDs will then show the status of the 4 labeled options (**(8) Fan Off at Heat Start**, **(4) Low Ambient Lockout**, **(2) Free Cooling Lockout**, and **(1) Lead / Lag)**.
- Press the UP or Down button to change the LED status to correspond to the desired Option Setup.
- To save the current displayed value, push the OPTION SETUP / STORE button and hold it for at least 2 seconds. When the value is saved, the green LED will flash a few times and then normal display will resume.

NOTE: While in either Setup mode, if no buttons are pushed for 60 seconds, the display will revert to its normal display, exiting the Option Setup mode. **When saving, the control board only saves the parameters for the currently displayed mode (Option Byte or Heat Delay).**

Heat Delay Setup

- Enter the Option Setup mode by pushing the OPTION SETUP / STORE button, and holding it for at least 2 seconds.
- The green status LED (Option Byte) will be turned on and the red status LED (Heat Delay) is turned off.
- Press the COMM SETUP / SELECT button to toggle into the Heat Delay Setup, the green LED will turn off and the red LED for Heat Delay will turn on.
- The 8, 4, 2 and 1 LEDs will then show the status of the Heat Delay, (See Table 26). Press the UP or Down button to change the LED status to correspond to the desired Heat Delay Value.
- To save the current displayed value, push the OPTION SETUP / STORE button and hold it for at least 2 seconds. When the value is saved, the red LED will flash a few times and then normal display will resume.

NOTE: While in either Setup mode, if no buttons are pushed for 60 seconds, the display will revert to its normal display, exiting the Option Setup mode. **When saving, the control board only saves the parameters for the currently displayed mode (Option Byte or Heat Delay).**

Table 26: Heat Delay

Heat Fan On Delay	Heat Fan Off Delay	Red LED 8	Red LED 4	Red LED 2	Red LED 1
60	180	On	On	On	On
60	90	On	On	On	Off
60	60	On	On	Off	On
60	30	On	On	Off	Off
45	180	On	Off	On	On
45	90	On	Off	On	Off
45	60	On	Off	Off	On
45	30	On	Off	Off	Off
30	180	Off	On	On	On
30	90	Off	On	On	Off
30	60	Off	On	Off	On
30	30	Off	On	Off	Off
0	60	Off	Off	On	On
0	30	Off	Off	On	Off
0	10	Off	Off	Off	On
Non-std	Non-std	Off	Off	Off	Off

Optional VAV Control Board Flash Codes

Flash codes are also utilized by the VAV add-on board to aid in troubleshooting optional VAV applications. Flash codes are displayed by a red LED located near the center of the board using a short on/off cycle (approximately 200-ms on and 200-ms off).

To verify that the board is functioning correctly, the LED will display a repetitive 1 second on, 1 second off "heartbeat". Do not confuse this "heartbeat" with the error flash codes shown in the table below. To prevent confusion, a 1-flash, flash code is not used.

Table 27: VAV Control Board Flash Codes

FLASH CODE	DESCRIPTION
On Steady	Control Failure
1 Flash	Not Applicable
2 Flashes	Loss of Communication with UCB
3 Flashes	Space Sensor Failure
4 Flashes	SAT Sensor Failure
5 Flashes	RAT Sensor Failure
6 Flashes	OAT Sensor Failure
7 Flashes	OH Sensor Failure
8 Flashes	RH Sensor Failure
9 Flashes	IAQ Sensor Failure
10 Flashes	OAQ Sensor Failure
11 Flashes	APS Sensor Failure
12 Flashes	Limit 2 Switch Open
13 Flashes	Purge
14 Flashes	VFD Input Failure
15 Flashes	Dirty Filter Switch
OFF	No Power or Control Failure

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